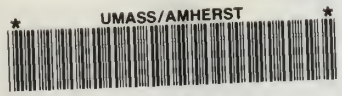

Low-Level Radioactive Waste

Management Plan

Volume I

The Commonwealth of Massachusetts

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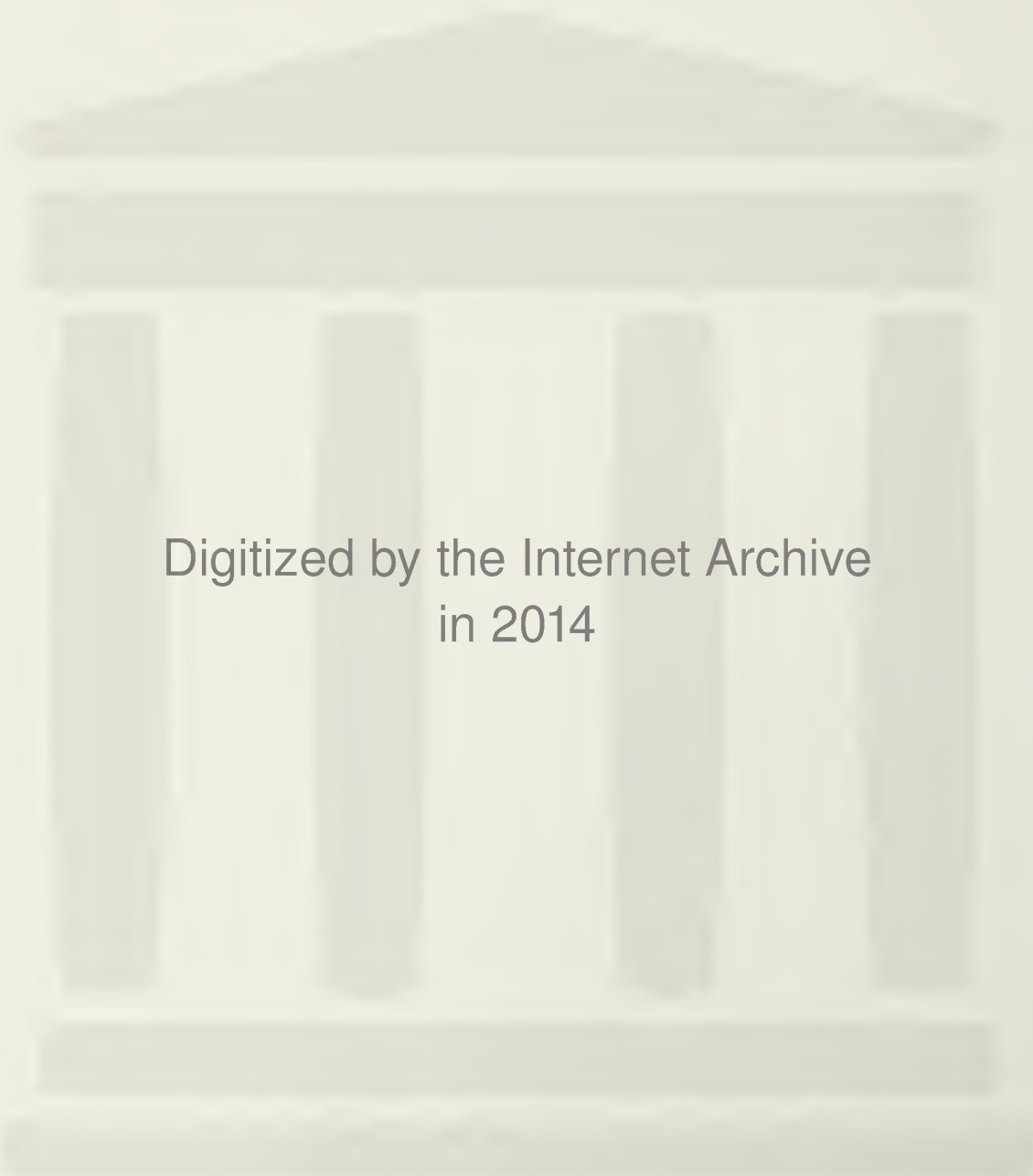

Low-Level Radioactive Waste
Management Plan

[Finals

Volume I

Directions for Low-Level Radioactive Waste Management in Massachusetts

January 1994

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Executive Director

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Abstract

This volume of the Massachusetts Low-Level Radioactive Waste Management Plan presents an "action plan" for low-level radioactive waste (LLRW) management in the Commonwealth. Options for short-term and long-range management of LLRW are presented in Chapter 4, and are a guide to decision-making by the Low-Level Radioactive Waste Management Board, the lead agency of the Commonwealth responsible for LLRW management. In addition, this volume summarizes all policy issues considered by the Management Board, and all recommendations adopted, to ensure the safe and environmentally-sound supervision of LLRW in Massachusetts. Detailed information on these issues is contained in VOLUME II of this Plan.

Acknowledgement

The author gratefully acknowledges the contributions and support of the Massachusetts Low Level Radioactive Waste Management Board and its staff in the review of this Low-Level Radioactive Waste Management Plan.

Notes

The Massachusetts Low-Level Radioactive Waste Management Plan is contained in two volumes. While certain terms used in VOLUME I are defined, all abbreviations, acronyms, and definitions appear in VOLUME II following the Table of Contents.

Mention of a commercial product or firm does not constitute an endorsement by the Low-Level Radioactive Waste Management Board or the Plan's author.

Table of Contents

List of Tables

List of Figures

Chapter 1: The State's Responsibility to Manage LLRW

Since the passage of the federal Low-Level Radioactive Waste Policy Act in 1980, and its strengthening amendments in 1985, Massachusetts and other states have been struggling with low-level radioactive waste (LLRW) management and disposal questions. Federal laws assign these responsibilities to the 50 states. Therefore, our state government must make decisions about ensuring the safe, effective, and environmentally-sound, long-term confinement of LLRW; avoiding LLRW generation where possible; reducing the volumes of waste once it is produced; and securing interim storage until LLRW disposal is available.

Over a decade has passed since the adoption of the first federally-mandated LLRW management requirements. During most of that time, until Dec. 31, 1992, the entire country's LLRW generators relied upon three LLRW disposal sites in Barnwell, South Carolina; Beatty, Nevada; and Hanford, Washington. After Dec. 31, 1992, two of those sites (Nevada and Washington) ceased accepting waste from Massachusetts and other states outside their region. The Nevada site closed permanently as of that date, and the Washington site stopped accepting waste except from the 11 western states that are members of the Northwest and Rocky Mountain Compact regions. The South Carolina Legislature decided to keep its Barnwell site open to out-of-region generators for up to 18 months from Jan. 1, 1993, through June 30, 1994. Any continuation of access beyond that period requires approval by the South Carolina Legislature.

Massachusetts is committed to managing LLRW in a responsible manner, assuring that disposal in a facility that provides for long-term isolation is available for wastes that are by-products of supplying numerous products and services in the Commonwealth -- such as hospitals diagnosing and treating diseases; biotechnology and medical research firms exploring cures for AIDS and other serious illnesses; universities providing educational and research opportunities; government entities protecting water quality; and nuclear-powered utilities providing electricity.

Some LLRW has already been generated and is currently in storage at more than 200 locations around the Commonwealth. Other LLRW will be produced and stored on site in the future. The choices in managing both are difficult ones for the Commonwealth and its citizens. However, failure to effect solutions could have potential impacts on the public's health, safety, and the environment, now and in the future.

LLRW Management Plan Contents

This LLRW Management Plan is a comprehensive blueprint for implementing Massachusetts policy regarding the management of LLRW in the Commonwealth. The Plan is divided into two volumes.

VOLUME I describes the factors affecting LLRW decision-making and summarizes the determination of need for storage, treatment, or disposal facilities detailed in Chapter 15 of VOLUME II. VOLUME I also presents an "action plan" for LLRW management that identifies four main options, namely (1) continuing efforts to identify another state or compact region willing to accept Massachusetts waste; (2) storing LLRW on site for the short term; (3) siting a centralized storage facility to manage LLRW off site and away from

its place of generation; or (4) building an LLRW disposal facility for long-term containment within the Commonwealth. The action plan is based upon the numerous recommendations found throughout the VOLUME II chapters. In addition, VOLUME I briefly describes the many issues affecting LLRW management that are detailed in VOLUME II.

Readers of VOLUME I can quickly obtain an overview of the numerous and complex LLRW management issues presented in VOLUME II, as well as their associated recommendations. VOLUME I provides enough information about the State's LLRW management options for interested readers to participate knowledgeably in public meetings, offer suggestions, and develop an overall understanding of the LLRW management and disposal challenges being addressed by the Commonwealth.

An appendix at the end of VOLUME II contains selected laws, regulations, and other documents pertaining to LLRW management.

A "Living Document"

The LLRW Management Plan contained in these two volumes is required pursuant to Massachusetts General Laws c.111H (Chapter 111H), the statute known as the "Low-Level Radioactive Waste Management Act." The Plan must be adopted by regulation by the Low-Level Radioactive Waste Management Board,[1] and implemented "...to provide for the safe and efficient management" of LLRW. The primary consideration guiding the Management Board's development of this master plan "shall be the protection of public health, safety, and the environment." [Chapter 111H, section 12(a)]

This Management Plan and the proposed regulations required to implement it were adopted on Dec. 22, 1993, following 17 statewide public hearings and briefing sessions held to receive public review and comment. The regulations to implement the Plan appear as Appendix E at the end of VOLUME II.

The LLRW Management Plan must be reviewed annually by the Management Board, and revised as necessary. It is, therefore, designed to be a "living document" which will allow modifications in the Commonwealth's policies on LLRW management and disposal to meet changing state and national conditions.

Questions about the content of this Plan should be referred to the Low-Level Radioactive Waste Management Board, 100 Cambridge Street, Room 903, Boston, MA 02202 (telephone [617] 727-6018).

[1] The Massachusetts Low-Level Radioactive Waste Management Board is the lead state agency charged with the development and implementation of LLRW management policy for the State.

Chapter 2: Factors Influencing LLRW Decision-Making

2.1 Introduction

The Commonwealth of Massachusetts must implement a strategy for long-term management of the low-level radioactive waste (LLRW) generated within its borders. Official assignment of this responsibility began Jan. 1, 1993, under the provision of applicable federal laws.

For several years, Massachusetts has been preparing to assume this obligation. In February, 1994, following a series of statewide meetings to gain public input on this LLRW Management Plan, the Low-Level Radioactive Waste Management Board will vote to adopt a management strategy, which may or may not culminate in storage or disposal facility siting within the Commonwealth.[1]

If siting is the route chosen, and if all the recommendations in this Management Plan are implemented, a two-year process will begin to identify environmentally-suitable candidate sites and a final, "superior" site. During the volunteer stage of siting, municipalities will be encouraged to volunteer to host a facility. State grants will be available to finance potential site communities' evaluations of the economic impacts of a facility within their communities.

Facility siting may not be selected as the solution to Massachusetts' LLRW problems, however. Other options that may be chosen by the Management Board include storing waste for several years on the premises where it was generated until a permanent solution is reached, or arranging for LLRW to be disposed of in one or more out-of-state facilities.

The State's decisions involving LLRW management are not easy ones. The management of any waste form -- LLRW, toxic chemical "hazardous" waste, hospital "biological" waste, and even the solid waste produced every day in homes and businesses -- can be emotionally charged, politically onerous, complicated, and difficult to resolve.

2.2 Considerations for Decision-Making

The factors that influence LLRW decision-making are briefly summarized below, and are followed

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[1] Chapter 3 of this volume, and Chapter 15 of VOLUME II, describe the Management Board's determination of need for LLRW storage, treatment, or disposal capacity. No requirement for additional treatment facility capacity is identified as being necessary to meet present LLRW management needs, or needs anticipated to arise within the next decade. Because the Management Board is prohibited by law [Massachusetts General Laws c.111H (Chapter 111H), section 17] from voting to site any facility that is not determined to be necessary, the Board cannot vote to initiate siting for an in-state LLRW treatment facility.

by notations of the chapters in VOLUMES I and II of this Management Plan where further explanation is provided. Many factors are interrelated, and need to be evaluated in connection with actions on the others.

- **Public health and safety.**

  LLRW is regulated by federal and state law because it has the potential to be injurious to the public's health and safety. [VOLUME II, Chapter 3]

- **Environmental protection.**

  In addition to protecting the public's health and safety, safeguarding the environment is a significant factor for consideration in developing LLRW management policy. [VOLUME II, Chapter 2]

- **Responsibility to ensure proper disposal of LLRW produced in Massachusetts.**

  State government has an obligation to assist its citizens by ensuring that public services such as transportation, water supply, and waste disposal are available to both residential and business taxpayers. [VOLUME II, Chapter 2]

- **Benefits provided by users of radioactive materials.**

  Products, services, and hospital clinical procedures result from the use of radioactive materials. Economic benefits estimated to total over $3 billion dollars in revenues to the Massachusetts economy in 1991 resulted from the uses of radioactive materials. In some, but not all, cases, LLRW was generated as a by-product. [VOLUME II, Chapter 4]

- **Federal mandates assigning LLRW disposal responsibility to each state.**

  The federal Low-Level Radioactive Waste Policy Act of 1980, and its Amendments Act of 1985, makes all state governments responsible for providing disposal capacity, either inside or outside the state's boundaries, for all LLRW generated within the state, except for wastes resulting from defense activities. This responsibility began officially on Jan. 1, 1993. [VOLUME II, Chapter 1]

- **Federal law provisions that regional groupings, or "compacts," of states may exclude waste importation, but single states may not.**

  In adopting the federal LLRW Policy Act and its amendments, Congress declared that "low-level radioactive waste can be most safely and efficiently managed on a regional basis," and encouraged states to establish regional agreements, known as "compacts," to site and operate regional disposal facilities. A significant incentive to regionalizing is provided in these laws: Regional compacts may exclude from the regional site LLRW which was generated outside the region. However, it is not clear that states choosing or forced by circumstances to "go it alone" in building disposal facilities would have the same authority. [VOLUME II, Chapters 1 and 6]

- **The state process directing policy-making on LLRW management.**

  The Massachusetts law, Chapter 111H, establishes a strong and active role in every area of LLRW management. The cornerstones of the law are requirements for:

  (1) planning for long-range LLRW management initiatives;

(2) public participation throughout all state and local LLRW management activities; and

(3) source and LLRW volume minimization to the greatest extent achievable.

These and other provisions of the law have directed the Commonwealth through a series of cautious and deliberative steps designed to ensure the protection of public health, safety, and the environment, and formulated to assure that LLRW facility siting can be accomplished, if a decision is reached to site within Massachusetts. Some states' LLRW management actions have hastened these activities; some have suffered from their lack of public process and planning. In addition, some states have faced legal and political hurdles aimed at stopping certain LLRW disposal facilities. [VOLUME II, Chapters 2 and 5]

- **Compact laws and political decisions prohibiting Massachusetts from joining existing regional compacts as a non-host state, or contracting for LLRW importation.**

Eight of the nine regional compacts in the nation which have existing disposal capacity, or are developing new disposal facilities, have compact law provisions, state laws, or compact commission policies effectively prohibiting Massachusetts from joining their compacts as a non-host state or refusing to accept out-of-region waste. They include the Appalachian, Central, Central Midwest, Midwest, Northwest, Southeast, Southwestern, and Texas Compacts. One of these compacts (Southeast) requires that any new state joining its region must begin siting a regional disposal facility immediately. The Midwest and Texas Compacts, like some of the others, allow out-of-region waste importation upon the affirmative vote of a majority of compact commissioners. In addition, the Midwest Compact allows the host state compact commission member (Ohio) to veto any importation decision. Unlike the other compacts, which have declared their opposition to out-of-region waste importation, no official action against importing such waste has been taken to date by either the Midwest or Texas commissions. However, officials from both Texas and Ohio indicate that no support exists for accepting Massachusetts LLRW.

The one remaining compact region (Northeast) has no compact law prohibiting out-of-region waste importation. However, Connecticut state law prohibits the Connecticut representative to the compact from supporting any waste importation unless approval has been given by the chief elected official of the town hosting Connecticut's disposal facility. [VOLUME II, Chapters 6 and 15]

- **State law requirement that a "determination of need" must be made before decisions on in-state facility siting can commence.**

The state's Low-Level Radioactive Waste Management Act, Massachusetts General Laws c.111H (Chapter 111H) requires that the Low-Level Radioactive Waste Management Board make a finding as to whether there is a requirement for additional facility capacity to meet present LLRW management needs or needs anticipated to arise within the next decade. This determination must be included in the LLRW Management Plan with a statement of the factual basis of such finding, and be subject to public review and comment, before any facility siting within the state is considered. Massachusetts is the only state in the nation whose law requires this formal, public-involved "determination of need" process. [VOLUME I, Chapter 3; VOLUME II, Chapters 2 and 15]

- **Public participation involving LLRW management decisions.**

Public participation is an extremely important element in the state's law and policies to manage LLRW. Citizens, municipal officials, LLRW generators, and other interested parties need to be involved

in the Commonwealth's decisions to plan and manage LLRW. [VOLUME II, Chapters 2 and 5.]

- **Waste minimization and its effects on facility capacity needs.**

  As noted, minimizing the sources of radioactive materials that can result in LLRW, and eliminating them where possible, as well as reducing the waste once it is generated, are important public policy commitments of state law. The effects of minimization and elimination policy on present and future capacity needs for LLRW storage, treatment, and disposal must be considered. [VOLUME II, Chapter 10]

- **Economics of facility siting and operation.**

  Storage, treatment, and disposal of LLRW is costly to LLRW generators, and may result in some expense to the public. However, the costs of failing to address this public health, safety, and environmental problem can be extraordinarily expensive. [VOLUME II, Chapters 11, 12, and 13]

- **Massachusetts' status as an "Agreement State" to assume regulatory authority over facility licensing, operation, closure, institutional control, and other facility-related regulatory activities.**

  The Commonwealth has applied to the U.S. Nuclear Regulatory Commission (NRC) for approval to regulate users of radioactive materials and any LLRW storage, treatment, or disposal facilities sited, built, and operated under the provisions of Chapter 111H. Once approved as an "Agreement State," Massachusetts will have greater authority to ensure public health, safety, and environmental protection over long-term LLRW management activities. Action on the Commonwealth's application is expected in 1994. [VOLUME II, Chapter 2]

- **State government's commitment to LLRW management.**

  State government has responsibilities in hundreds of directions. LLRW management requires a commitment of the Governor, state resources, human energy, agency coordination, and "political will." [VOLUME II, Chapter 1]

- **Public acceptance.**

  Significant opposition to any plan is likely to prevent or delay its implementation. [VOLUME II, Chapters 5, 16, and 17]

- **Generators' role in the development and implementation of state LLRW management policy.**

  While the state has a responsibility to ensure that LLRW management and disposal are accomplished in ways designed to protect public health, safety, and the environment, generators of LLRW have an equally definitive obligation to assist the state in achieving management solutions that benefit all citizens.

All these factors illustrate the complicated decisions involving LLRW management. Decision points could be legally challenged, and could delay or prevent implementation of a plan for LLRW management and leave the Commonwealth and its citizens without resolutions that protect the public health, safety, and the environment.

Chapter 3: The Determinations of Need for Storage and Disposal Capacity

3.1 Introduction

The Commonwealth's Low-Level Radioactive Waste Management Law, Massachusetts General Laws c.111H (Chapter 111H), requires this low-level radioactive waste (LLRW) Management Plan to contain a finding as to "whether there is a requirement for additional (storage, treatment, or disposal) facility capacity to meet present low-level radioactive waste management needs or needs anticipated to arise within the next decade."

This determination is a crucial component in the LLRW management planning process. It provides guidance to the public in considering comments on this Plan, and it offers direction to the Management Board in determining the most appropriate short- and long-term solutions for LLRW management in the Commonwealth.

Massachusetts is the only state in the nation that includes a formal LLRW management planning process that culminates in a "determination of need" finding, public hearings on that determination (as well as other recommendations in the Plan), and a subsequent vote for definitive action by the State. It is an important step in the public participatory process incorporated into Chapter 111H.

The finding of a need for additional facility capacity must have been made in order for the Management Board to consider siting an LLRW storage, treatment, or disposal facility within the Commonwealth. Without such a finding, no siting may occur, even if the Board wished to proceed.

3.2 Need for Storage, Treatment, and Disposal

The determination of need for storage, treatment, and disposal capacity is described in detail in Chapter 15 of VOLUME II of this Management Plan. A finding is presented in the three major areas of LLRW management: storage, treatment, and disposal.

Storage Capacity

With regard to storage, all LLRW generators can store LLRW on the premises of their companies and institutions for an interim period of up to five years, the maximum storage period currently recommended by the NRC. Because of the contract successfully executed by the Management Board which allows continued access to the Barnwell, South Carolina, LLRW disposal site through June, 1994, LLRW generators shipping their waste for disposal to Barnwell can store on site for five years after that facility ceases to be available, i.e., through June, 1999. Generators who choose not to ship their waste to Barnwell, perhaps due to the high per-cubic-foot surcharge that was imposed as of Jan. 1, 1993 ($220), may store

on site from January, 1993, through December, 1997.

If the Commonwealth were to consider siting a centralized storage facility, it would not be needed until January, 1998, assuming all generators could store on site for the maximum of five years through December, 1997. However, it is questionable how long storage in a centralized storage facility would be allowed. The NRC currently discourages more than five years of on-site storage, and is not expected to extend that time period, either for individual generators or for off-site centralized storage facilities. The NRC's position against longer-than-five years of on-site storage is merely a "guidance" to LLRW generators; it has yet to issue regulations establishing a firm policy on this issue. (However, the NRC has issued a Federal Register notice of its intent to establish a maximum on-site storage limit.)

Centralized storage may also be considered as a means to hold waste pending any new disposal agreements that the Commonwealth can negotiate with other states. For example, if Massachusetts were to reach an agreement that another state would accept for disposal Massachusetts-generated waste in the year 2010, a decision to site an interim centralized storage facility might be the appropriate management action in order to provide a safe, environmentally-sound centralized storage location prior to waste acceptance in an out-of-state disposal facility.

Because of the limits placed on storage, any centralized storage facility would serve only as an interim solution for Massachusetts LLRW management needs.

Treatment Capacity

Because treatment capacity exists for LLRW both in state and out of state, there is no need to develop a treatment facility within the Commonwealth. Treatment of mixed waste[1] is the only concern. However, newly-permitted and licensed companies around the country are slowly filling the mixed waste treatment void. In addition, the U.S. Department of Energy (DOE) has indicated support for a DOE-sited national mixed waste disposal facility. This proposal is a long way from realization, but will be monitored and promoted as a valid possibility to aid all states in resolving their mixed waste problems, especially since the volume of mixed waste produced by DOE's research and development activities significantly surpasses the volume of mixed waste generated by non-federal licensees.

Disposal Capacity

On behalf of the Commonwealth, the Management Board has a contract with the Southeast Compact Commission that provides Massachusetts LLRW generators access to the Barnwell, South Carolina, disposal site until June 30, 1994. The agreement allows the Southeast Compact Commission to terminate access at any time the Commission determines that a state or compact region is not making "adequate progress" to provide for LLRW disposal, or has taken an "overt action" which "substantially" impedes progress towards LLRW disposal. The Management Board has successfully retained this contract for the past 12 months, and has taken steps to protect against early termination. However, some Southeast Compact Commissioners have already suggested ending its contractual relationship with the Commonwealth, believing Massachusetts will never fulfill its obligations under the federal Low-Level Radioactive Waste Policy Amendments Act (LLRWPAA). At the Commission's meeting in October, 1993, eight of the 16 Commission members present voted to terminate the Massachusetts contract. Because the vote ended in a tie, contract cessation did not occur. However, the Commission notified the Management Board in writing

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[1] "Mixed waste" is LLRW which contains, or exhibits the characteristics of, hazardous waste as defined by the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (DEP).

later that month that another termination vote would be taken if three actions did not transpire:

(1) approval of this LLRW Management Plan in December, 1993;

(2) approval by the Massachusetts Legislature by the end of the 1993 legislative session of a $45 million bond authorization for LLRW management activities; and

(3) a vote on Feb. 16, 1994 (the date set by the Management Board) on options for long-range LLRW management, including whether or not to site an LLRW disposal facility within the Commonwealth.

Favorable action on items (1) and (2) above occurred on schedule. Therefore, if the Management Board votes to initiate disposal facility siting within the Commonwealth on Feb. 16, 1994, the Southeast Compact Commission will not likely terminate the contract. However, if the Board does not vote to initiate such siting, the contract with the Southeast Compact Commission is expected to be terminated in May, 1994, or 90 days after the Compact Commission votes on termination.[2]

While it can be argued that termination within a month or two of the June 30, 1994, end date of the contract is less onerous to Massachusetts generators than contract cessation prior to that time, such action, if it were to occur, could have more deleterious effects. For example, if the South Carolina Legislature votes to extend access to the Barnwell disposal site beyond June 30, 1994, it may be less likely that a state that had lost its previous contract with the Southeast Compact Commission would be successful in negotiating a new access contract.[3]

All of these considerations are merely speculative, however, as it is not known at this time what will happen regarding the availability of the Barnwell disposal facility.

Therefore, unless the State of South Carolina decides to extend access to its facility after June, 1994, LLRW generators in Massachusetts and other states will have no disposal site available after that date, except for the limited disposal available at a site located in Clive, Utah. This site, operated by Envirocare of Utah, Inc., is limited by its license to accept only high-volume, low-activity bulk wastes, such as soils and building rubble. It will also accept mixed waste for disposal -- but only the same low-activity materials. Envirocare cannot take the place of the Barnwell facility.

There is also uncertainty whether any of the newly developing LLRW disposal facilities in other states and compact regions will accept Massachusetts LLRW. Six of the seven new regional compacts that are developing LLRW disposal facilities (Appalachian, Central, Central Midwest, Midwest, Southwest, and Texas) have compact laws or approved compact commission policies effectively prohibiting Massachusetts from joining their compacts as a non-host state or refusing to accept out-of-region waste. The Midwest and Texas Compacts, like some of the others, allow out-of-region waste importation upon the affirmative vote of a majority of compact commissioners. In addition, the Midwest Compact allows the host state compact

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[2] The Southeast Compact Commission's "import policy" which is referenced in the contract, provides a 90-day notification to LLRW generators if access is denied. The Commission may not wait until the Board's Feb. 16, 1994 scheduled action. Instead, it may vote before that date to terminate the contract, conditioned upon a negative Board vote on siting.

[3] Michigan generators lost access to the Barnwell disposal site in November, 1990; that state has failed to regain access ever since. On the other hand, the Central Interstate Compact region lost access on July 1, 1993, but their contract was reinstated in October, 1993.

commission member (Ohio) to veto any importation decision. Unlike the other compacts, which have declared their opposition to out-of-region waste importation, no official action against importing such waste has been taken to date by either the Midwest or Texas commissions. However, officials from both Texas and Ohio indicate that no support exists for accepting Massachusetts LLRW.

The one remaining new compact region (Northeast) has no compact law prohibiting out-of-region waste importation. However, Connecticut state law prohibits the Connecticut representative to the compact from supporting any waste importation unless approval has been given by the chief elected official of the town hosting Connecticut's disposal facility. In addition, officials of the Northeast Compact and the two states that comprise it (Connecticut and New Jersey) have publicly expressed their opposition to accepting waste from Massachusetts or elsewhere.[4]

Of the old regional compacts that have existing LLRW disposal facilities, the Southeast Compact (already mentioned in connection with access to the Barnwell disposal site) is developing its next regional disposal facility in North Carolina. Compact law allows importation by a majority vote of the Compact Commission, with the affirmative votes of the two members of the host state. The new North Carolina site is being developed for the Southeast Compact's disposal needs over 30 years; there is no intent on the part of North Carolina to authorize access to states outside the compact region. In addition, if Massachusetts sought to join the Southeast Compact in order to gain access, a compact provision would require Massachusetts to begin immediately (before the North Carolina site) to identify a location in Massachusetts for the entire Southeast Compact region.

The other regional compact with an existing LLRW disposal site is the Northwest Compact, which controls the Hanford, Washington, disposal site. Compact law prohibits the Compact Committee from approving any arrangements to accept out-of-region waste without the affirmative vote of the committee member representing the host state. In addition, host state Washington law directs the Washington committee member to approve access only for states in the Rocky Mountain Compact or for states that (1) generate less than 1,000 cubic feet of waste annually, and (2) are contiguous with a member state of the Northwest Compact. On Dec. 10, 1992, the Compact reinforced its prohibition on access by adopting a resolution stating that it will accept only LLRW that was generated in the Northwest or Rocky Mountain compact regions, or that "is the subject of a specific agreement previously or hereafter approved by the Northwest Compact Committee."

New York is the only unaffiliated state[5] proceeding with the development of an LLRW disposal facility. New York law prohibits it from accepting out-of-state LLRW.

Table 3-1 summarizes the prohibitions on LLRW importation, and each state or regional compact's progress in providing disposal capacity.

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[4] However, Northeast Compact officials, and those of the two member states, have continued active discussions with Massachusetts regarding a regional LLRW disposal solution. The discussions are not perceived to be for the purpose of accepting Massachusetts as a non-host compact member, or of taking Massachusetts LLRW into a Connecticut or New Jersey site (both states are siting disposal facilities in this region). Rather, the discussions are held for the purpose of convincing Massachusetts to build a disposal facility that will accept Connecticut and New Jersey LLRW.

[5] "Unaffiliated" states are those which are not part of any regional compact. The unaffiliated states, districts and territories, include Massachusetts, Michigan, New Hampshire, New York, Puerto Rico, Rhode Island, and Washington, DC. There are a total of 10 regional LLRW compacts, counting the new Texas-Maine-Vermont compact.

Table 3-1
States and Regional Compacts with Current or Developing LLRW Disposal Capacity
Summary of Waste Importation Restrictions and Siting Status

Compact Region	Host State	Type of Facility[1]	Facility Technology	Status (as of December, 1993)	LLRW Import Restrictions/Conditions
Appalachian	Pennsylvania	D	Above-ground. Packages into Concrete Overpacks into Concrete Modules	"Second stage" statewide screening completed at end of 1993; "stage three" screening in 1994 will lead to identification of three possible sites for detailed site characterization. Considering "volunteer" process as part of site identification.	PA law prohibits waste import.[2] Other compact provisions prohibit MA from joining the region.
Central	Nebraska	D	Above-ground. Packages into vaults into Concrete Building	Site selected near Butte. License application under review. Nebraska Governor challenging whether "community consent" siting requirement was met. Site reconfigured to avoid wetlands.	Compact law prohibits waste import unless compact commission votes to allow. Host state representative on Commission has veto.
Central Midwest	Illinois	D	Above-ground. Packages into Concrete Overpacks into Concrete Cells	Site in Martinsville, selected through process conducted by Illinois Dept. of Nuclear Safety, supported by local city council. Community benefits contract negotiated. In October, 1992, State's Facility Siting Commission declared that site did not meet siting criteria. Siting law modified in March, 1993. New siting process underway.	Compact Commission has banned the import of out-of-region LLRW for disposal.
Midwest	Ohio	D	Not yet chosen	Blue Ribbon Commission and Governor's Advisory Committee submitted their recommendations to the Governor in September, 1993. Legislation to create an Ohio siting process expected to be filed in December, 1993, or January, 1994.	Compact allows import agreements by majority vote of Commission. Host state has veto. Commission members currently opposed to importation.
None[3]	New York	IS, then D	Above-ground. Disposal technology not yet chosen	Legislation allowing use of old West Valley site for interim storage, then disposal, under consideration by N.Y. Legislature. N.Y. siting authority has placed on hold its work to characterize candidate sites; is evaluating what type of disposal technology to utilize.	New York law prohibits import of out-of-state LLRW for disposal. State officials oppose acceptance of out-of-state waste, and do not predict a change in current law. New York's "go-it-alone" status and importation ban could be challenged, however.

Table 3-1
States and Regional Compacts with Current or Developing LLRW Disposal Capacity
Summary of Waste Importation Restrictions and Siting Status
(continued)

Compact Region	Host State	Type of Facility[1]	Facility Technology	Status (as of December, 1993)	LLRW Import Restrictions/Conditions
Northeast	Connecticut and New Jersey	D	Above-ground. Packages into Concrete Overpacks into Concrete Vaults or Cells Not yet chosen	Both states' siting agencies have developed a new "volunteer" process, which will begin to be implemented in 1994.	No Compact prohibitions on LLRW importation. Officials of both states and the Commission currently oppose accepting out-of-region waste, however. Connecticut law prohibits its Commission member from approving waste importation unless supported by chief elected official of Connecticut site community.
Northwest	Washington	D	Shallow land burial	As of Dec. 31, 1992, Northwest Compact Committee ceased accepting LLRW from outside its region and that of the Rocky Mountain Compact, which has a contract with Northwest.	Importation allowed only by affirmative vote of Washington Compact Committee member. Washington state law prohibits access outside the compact region, with the exception of any agreements the committee may adopt, namely its contract with the Rocky Mountain states.
Rocky Mountain	None	--	--	Compact Region has contract with Northwest Compact to use Washington disposal site.	--
Southeast	N. Carolina	D	Above-ground. Packages into Concrete Overpacks into Concrete Vaults or Modules	Selected "preferred site" in December, 1993, of 2 sites characterized. Barnwell site in S. Carolina remaining open to out-of-region generators through June 30, 1994, and through December 31, 1995, to generators within the Southeast Compact.	Compact allows import agreements by majority vote of commission. Host state has veto. North Carolina does not support out-of-region LLRW importation.

Table 3-1
States and Regional Compacts with Current or Developing LLRW Disposal Capacity
Summary of Waste Importation Restrictions and Siting Status
(continued)

Compact Region	Host State	Type of Facility[1]	Facility Technology	Status (as of December, 1993)	LLRW Import Restrictions/Conditions
Southwest	California	D	Near-surface disposal with "enhancements." Packages into trenches	Site selected in Ward Valley (Mojave Desert). License application approved, September, 1993. Because land is federally-owned, California is trying to arrange a land transfer; U.S. Secretary of the Interior has postponed transfer, until outcome of a state court suit seeking an adjudicatory hearing on West Valley site, license, etc.	No compact law prohibition. 2/3 vote of Compact Commission required to accept out-of-region waste. Commission has publicly voted not to support LLRW importation.
Texas-Maine-Vermont	Texas	D	Near-surface. Packages into Modular Concrete Canisters into trenches	Texas has purchased a 16,000 acre parcel for site. License application under review.	Compact law allows import agreements by majority vote of commission. Maine and Vermont are restricted to shipping no more than 20% of total Texas volume over 50 years. Texas officials currently oppose importation from large-generating states, like Massachusetts.

[1] Facility Type: Disposal = D, Storage = S, Treatment = T and I = Interim
[2] Pennsylvania's law allows out-of-region waste acceptance in an "emergency." However, a state or region sending its waste to the PA site must agree to accept an equal volume of waste from the Appalachian Compact, once the emergency has ended.
[3] New York is siting an LLRW facility for its own waste, and not as part of a region. It is called an "unaffiliated" state because it has no connection with a regional compact.

Determinations of Need Summarized

As noted, the siting of any in-state LLRW facility is dependent upon a finding as to whether there is a requirement for additional facility capacity to meet present LLRW management needs or those anticipated to arise within the next decade. Each determination is elaborated in detail in Chapter 15 of VOLUME II. In summary, the Management Board determinations of need are:

Storage Capacity. As long as on-site storage is possible, and the NRC allows up to five years of on-site storage, no need exists through the latter part of the 1990s to establish a centralized storage facility in the state. However, a centralized storage facility may be an appropriate Interim or emergency solution under certain circumstances, for example, if the Commonwealth were able to arrange for another state to accept Massachusetts-produced LLRW at a future date within the operational period allowed by such an interim storage facility.

Treatment Capacity. Because various commercial treatment facilities operate throughout the country to process LLRW for later disposal,and are expected to continue (and expand) their capabilities, no need exists to establish an in-state LLRW treatment facility at the present time or through the next decade. However, out-of-state treatment capacity will be monitored continuously to ensure its availability.

No need exists to develop a treatment facility for mixed waste generated in Massachusetts at the present time or in the next decade. Some out-of-state mixed waste treatment facilities are capable of processing a major portion of the mixed waste generated in the Commonwealth. The remainder will be stored on site until a decision is reached by DOE regarding its present willingness to consider siting one or more mixed waste disposal facilities for all the mixed waste produced nationally, by both federal and non-federal generators.

Disposal Capacity. The availability of the disposal site in South Carolina will soon end. The disposal site in Utah is restricted by its license from accepting the majority of present and future Massachusetts LLRW. New disposal facilities in various stages of development disallow access as a result of state or regional compact law, or current policy. A need exists, therefore, to provide disposal for the approximately 20,000-25,000 cubic feet of LLRW expected to be produced annually in the Commonwealth, plus approximately 450,000 cubic feet of waste that will result from the decommissioning of the Yankee Rowe and Pilgrim Station nuclear power plants, and other large radioactive materials users in the Commonwealth.

These determinations of need restrict the Management Board to votes on siting an LLRW storage facility and/or an LLRW disposal facility; no vote to site a treatment facility is allowed, due to the determination that treatment capacity is available now and through the next decade. These determinations **do not obligate** the Board to initiate siting; they merely guide the Board in its decisions, if siting is determined to be an appropriate LLRW management strategy.

If, at some future date, conditions regarding LLRW treatment were to change and the Management Board were to ascertain that a need exists for a treatment facility, this Management Plan would first have to be amended before the Board could consider in-state LLRW treatment facility siting.

Chapter 4: Strategic Options Plan for LLRW Management

4.1 Strategic Options Plan Introduction

The Low-Level Radioactive Waste Management Board's decision whether or not to initiate steps to identify an In-state storage or disposal facility site, or to follow a non-siting option, is pivotal to the Commonwealth's major low-level radioactive waste (LLRW) management actions. That decision will occur in February, 1994.

Statewide public meetings and briefing sessions were held in February, 1993, through June, 1993, so that representatives of the Management Board, the Massachusetts Department of Public Health (DPH), and the Massachusetts Department of Environmental Protection (DEP) could explain their draft regulations and draft LLRW Management Plan to the public, answer questions, and receive comments. Following a subsequent time period to allow the submission of any written observations from citizens who may not have had an opportunity to testify at the public hearings, the three agencies evaluated over 3,500 public comments, and made changes they felt were appropriate in their draft regulations and draft Plan. In December, 1993, or January, 1994, the three agencies adopted their regulations and the LLRW Management Plan, incorporating some citizens' recommendations, and issued a Public Comment Response Report summarizing comments and agency responses.

Only after these actions have been completed, may the Management Board vote to implement one or more of the applicable strategic options identified in four "performance plans," as follows:

(1) an **Out-of-State Performance Plan** which continues the present efforts to negotiate disposal solutions with governmental entities in other states;

(2) an **On-Site Storage Performance Plan** to ensure safe, environmentally-suitable storage at the locations where LLRW is generated, for at least five years (and longer if possible);

(3) a **Centralized Storage Performance Plan** to site within the Commonwealth a centralized facility for at least five years of storage (and longer if possible); and

(4) a **Disposal Facility Siting Performance Plan** to site a disposal facility within Massachusetts for the long-term isolation (perhaps 300-500 years) of LLRW.

The decision points for each of these four strategic options are summarized in the next four sections of this chapter.

Options (2) and (3) listed above could be implemented as components of the Management Board's "Interim and Emergency Storage Plan" to take effect "whenever it appears that no facility is or will be available to accept LLRW generated within the Commonwealth. [Chapter 111H, section 12] Details of this plan can be found in Chapter 12 of VOLUME II. However, these options could also be implemented without

utilizing the Interim and Emergency Storage "short-cuts" authorized in Chapter 111H.

An Interim and Emergency Storage Plan may have several components. For example, it could involve contractual agreements for interim storage with facilities located outside Massachusetts. In addition, it could include the development of on-site storage plans for every Massachusetts generator. Or, it could involve the development of a centralized storage site as an "interim or emergency storage facility" within the Commonwealth.

The Management Board's existing Interim and Emergency Storage Plan is comprised of three elements:

(1) Frequent notifications to Massachusetts LLRW generators of possible loss of access, and the need for generators to initiate steps to ensure safe, environmentally sound on-site storage for all their LLRW;

(2) Procedures to ensure that Massachusetts generators, that may wish to ship their LLRW out of state for treatment, and then have it returned to them for on-site storage, would not be hampered by requirements of other states pertaining to the processing of LLRW and its return to Massachusetts; and

(3) Procedures to protect the Commonwealth's interests regarding denial of access events; and to ensure a coordinated state agency response to such events, with involvement of LLRW generators and the public.

The Board is fulfilling the first part of the Interim and Emergency Storage Plan through periodic communications with Massachusetts LLRW generators on the status of access to out-of-state disposal sites. That activity is an on-going Board effort.

The Board accomplished the second element of the plan when it established a procedure on May 15, 1991, regarding the re-entry of LLRW into the Commonwealth after shipment out of state.[1] This policy was developed out of a desire to encourage generators to have their waste treated, prior to on-site storage. It also evolved from a concern that out-of-state LLRW treatment companies would refuse to process LLRW from states that have no disposal destination, in order to avoid the costs and potential liability of having to take ownership of any orphaned LLRW.

To fulfill the third component of its Interim and Emergency Storage Plan, the Board began discussions in June, 1991, of a draft "Coordinated State Agency Response," to identify a set of procedures to apprise and involve all other involved state agencies (i.e., the offices of the Governor, Lt. Governor, Attorney General, DPH, Department of Labor and Industries), and to inform LLRW generators, and the public, of actions relating to loss-of-access events.

The procedures were formalized into a draft that was distributed for comments to the various agencies named above, and to LLRW generator groups and interested citizens. However, because the Board was successful in maintaining access to the Barnwell, South Carolina, disposal site, the "Coordinated State Agency Response" portion of the plan remains in draft form.

In considering the components of its Interim and Emergency Storage Plan, the Management Board also discussed the concept of developing a centralized interim or emergency storage facility to provide a

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[1] The Board's re-entry policy is contained in VOLUME II, Chapter 12, section 12.4.

single, monitored, in-state location for interim LLRW storage, once access to the state-controlled LLRW disposal sites in South Carolina, Nevada and Washington, ceased to be available. Using data from its 1989 and 1990 surveys of radioactive materials users, the Board determined that all Massachusetts generators felt they could handle their storage needs on site, with the exception of three small-volume LLRW generators.

As a result, the Board concluded that no need existed at that time to site, develop, and operate a centralized interim and emergency storage facility, when only a few small-volume generators expressed a need.

Nevertheless, if the Board decides to adopt performance plan (3), to site a centralized storage facility within Massachusetts, the Board could conduct its siting activities by following all of the siting procedures described in Chapter 111H, or, the Board could utilize the shortened procedures allowed if it determines that an emergency exists "that no facility is or will be available to accept LLRW generated within the Commonwealth."

The emergency procedures enable the Management Board (or its designee) to serve as the facility operator, and thereby apply for a license for such a facility. [Chapter 111H, section 12] Section 12 also authorizes the Board to construct and operate a facility to accept LLRW for interim or emergency storage. These provisions thereby substitute the requirements pertaining to the selection of a facility operator by a Community Supervisory Committee (CSC) appointed as a result of "superior site" selection; and other related steps in Chapter 111H (including statewide screening, possible locations, detailed site characterization, etc., which are described in VOLUME II, Chapter 2).

Section 12 of Chapter 111H does require, however, that no interim or emergency storage facility may be constructed unless DPH has conducted an environmental monitoring program at the storage site, as required in section 36 of the Act, and has produced representative baseline date about the site in order to provide early warning of the magnitude and extent of any radionuclide migration, and to provide reliable environmental data throughout the various phases of facility development, operation, closure, and institutional control. Section 12 also dictates that the Management Board must specify in its Interim and Emergency Storage Plan, the "maximum length of time during which such a facility may be utilized."

Because an interim or emergency storage facility would be evaluated for licensure on exactly the same criteria in the DPH licensing regulations as any other facility, an interim or emergency storage facility would have to satisfy the same environmental standards as a long-term facility.

Since a centralized storage facility is not currently part of the Board's Interim and Emergency Storage Plan, the Board would be required pursuant to section 12 of Chapter 111H to include such a provision in its plan, were it to select the third performance plan option.

4.2 Out-of-State Performance Plan

This option suggests a continuation of the actions which the Commonwealth has undertaken to negotiate with other states that either have existing LLRW disposal sites, or are developing new disposal facility capacity. It is an action that does not involve siting within the Commonwealth, but includes a continuation of the need to monitor the future disposal requirements of Massachusetts LLRW generators.

This option may be combined with one or more of the others.

Step #1 to Implement an Out-of-State Performance Plan: Continue Discussions with Other States

For several years, the Commonwealth has been discussing the possibilities of joining with one or more "siting" states -- that is, unaffiliated states as well as states in regional compacts that are developing new disposal facilities. Although these discussions have not to date been successful -- as other states have either political objections to, or statutory prohibitions on accepting Massachusetts LLRW -- discussions would continue, since positions on LLRW acceptance could change. [See VOLUME II, Chapter 15, regarding current legal and political impediments of other states regarding acceptance of Massachusetts LLRW in their disposal facilities.]

Step #2 to Implement an Out-of-State Performance Plan: Make a Formal Financial Offer

Many of the states in the process of planning or identifying sites for LLRW disposal are facing financial difficulties, due to high siting costs. Pursuant to the recommendations listed in Chapter 5 of this volume, the Commonwealth would prepare a formal financial offer to each new "siting" state or compact region that includes an initial "entry" fee as well as continuous LLRW generator surcharges to help fund facility operation. This financial offer would officially be submitted by the Governor to all states that currently operate LLRW disposal facilities, and to those in the process of developing sites.

Step #3 to Implement an Out-of-State Performance Plan: Continue to Monitor Siting Activities in Other States

States and compact regions that presently refuse to accept Massachusetts LLRW may modify their policies or laws in the future. Massachusetts would be watchful of opportunities to negotiate access agreements as state leaders or other conditions change.

Step #4 to Implement an Out-of-State Performance Plan: Prepare for Possible Legal Consequences of the State's Failure to Provide Disposal Capacity

The federal Low-Level Radioactive Waste Policy Amendments Act (LLRWPAA) requires that "each state shall be responsible for providing, either by itself or in cooperation with other states, for the disposal" of LLRW. This responsibility is a serious duty, assigned under federal law, and the Management Board would prepare to address any legal ramifications that could result from the failure to meet this obligation.

Step #5 to Implement an Out-of-State Performance Plan: Continue to Monitor the Disposal Needs of Massachusetts LLRW Generators

A 1991 survey of radioactive materials users in the Commonwealth revealed that an excess of $3 billion dollars of benefit to the Massachusetts economy, as well as 36,000 jobs in the Commonwealth, are attributable to activities that can generate LLRW. [See VOLUME II, Chapter 4]

The LLRW disposal needs of these businesses, hospitals, universities, and other radioactive materials users must be addressed. Their generation of LLRW as a result of providing products and services in the state cannot be ignored for either economic or environmental reasons. The Commonwealth would monitor the activities of these entities, to ensure that aggressive state action is underway before some radioactive materials licensees are forced to consider such measures as down-sizing, relocation, or an end to the products and services provided through radioactive materials use.

Step #6 to Implement an Out-of-State Performance Plan: Negotiate for Access to Barnwell and/or Hanford

Massachusetts has been aggressively working to ensure that the LLRW generators in this state will have access to the LLRW disposal site in Barnwell, South Carolina, through June 30, 1994, as permitted by a new South Carolina law. That law allows the Southeast Compact Commission to terminate access at any time it determines that "adequate process" is not being made, or that an "overt action" has significantly slowed a state (or region's) progress toward providing disposal capacity. Negotiations for access after Dec. 31, 1992 -- when the South Carolina, Nevada, and Washington disposal sites were allowed to deny access under provisions of federal law -- occurred at the end of 1992. Discussions concluded in the successful execution of an 18-month access contract between the Southeast Compact and the Management Board, on behalf of the Commonwealth and its LLRW generators.

The disposal site in Hanford, Washington, closed to LLRW generators in Massachusetts and other states on Dec. 31, 1992. However, Hanford remains open as the regional disposal site for the Northwest Compact of states (Alaska, Hawaii, Idaho, Montana, Oregon, Utah, Washington, and Wyoming), and has a contract with the Rocky Mountain Compact states (Colorado, Nevada, and New Mexico) to accept that region's waste until the Hanford site closes in approximately 70 years.

Discussions would continue between Massachusetts, South Carolina, and Washington about extending access beyond the present closing dates.

Step #7 to Implement an Out-of-State Performance Plan: Lobby Congress to Change Federal Law

Massachusetts, like all states, is responsible for LLRW disposal because of the passage of federal law. However, what was adopted by Congress, can be modified or repealed by Congress. To date, Congress has not been willing to re-examine the LLRW management laws it adopted during the 1980s. However, a coalition of states wishing to transfer LLRW responsibility to the federal government, or desirous of having Congress designate existing or new LLRW disposal sites for use by the entire nation, may have success in such a lobbying effort. Massachusetts would join others in organizing a group of states with similar goals.

While pursuing this action, however, the Commonwealth would establish a timetable whereby the state would assume an alternative performance plan or plans if the Congress were to fail to change federal law.

Step #8 to Implement an Out-of-State Performance Plan: Contract with Other Countries

There may be countries around the world that would consider accepting LLRW from Massachusetts generators. The U.S. State Department currently discourages any negotiations unless initiated by a foreign country, rather than inaugurated by Massachusetts or other states within the United States. However, following the recommendations listed in Chapter 5 of this volume, Massachusetts would encourage its LLRW generators that do business with foreign countries to begin private discussions with countries that have disposal site capacity.

Step #9 to Implement an Out-of-State Performance Plan: Develop a Waste Exchange Agreement

The Commonwealth would develop a formal proposal and initiate discussions with other states interested in swapping waste streams to avoid siting more controversial facilities than are actually needed. For example, Massachusetts could agree to site a treatment or disposal facility for solid waste generated in the Commonwealth as well as in another state. In exchange, the other state would site an LLRW disposal facility for its LLRW as well as that produced in Massachusetts.

While this action results in "no-siting" of an LLRW disposal facility within Massachusetts, it would require the siting of a facility for some other type of waste stream.

Step #10 to Implement an Out-of-State Performance Plan: Offer to Serve as the Second Host State

If all of the other non-siting actions result in no long-term LLRW disposal solution for the Commonwealth, the State would offer to host a "second" regional facility for an existing compact, in exchange for joining that region and gaining access to its "first" disposal facility. This action, if successful, would avoid the need to site a Massachusetts-based facility for 30 or more years; and thereby postpone any siting requirements for that time period.

However, this action would require Massachusetts to agree to certain legal conditions to ensure the other states in a regional compact that the Commonwealth would fulfill its future commitments. It would also require the other party states in most of the existing regional compacts to modify their compact laws, since current compact prohibitions exist for such an arrangement.

Step #11 to Implement an Out-of-State Performance Plan: Re-Assess "On-Site Storage, "Centralized Storage" and "Disposal Facility Siting" Performance Plans

Failing any long-term solutions from the Out-of-State Performance Plan summarized in #1 through #10, the Management Board, by a date certain, would re-assess the three storage and disposal facility siting options.

4.3 On-Site Storage Performance Plan

This option entails the "non-siting" component of on-site storage, at the locations where LLRW is generated, for the maximum length of time that would be allowed by the licensing agency (i.e., the NRC if Massachusetts is not yet an Agreement State, or DPH if such an agreement has been authorized). On-site storage is currently discouraged by the NRC to last longer than five years. However, it is not certain what, if any, action NRC/DPH would take were storage to continue longer than that time period.

Step #1 to Implement an On-Site Storage Performance Plan: Fully Effectuate the Interim and Emergency Storage Plan

The Board's current Interim and Emergency Storage Plan includes a component for on-site storage. The Board would review its plan, add any necessary provisions, and finalize the third component, namely the "Coordinated State Agency Response," in order to prepare other state agencies, LLRW generators, and

the public for the impacts of on-site storage.

Step #2 to Implement an On-Site Storage Performance Plan: Timely Notification to Generators of On-Site Storage Requirement

Since 1989, the Management Board has been notifying all radioactive materials licensees in the Commonwealth that the three disposal sites in South Carolina, Nevada, and Washington planned to stop accepting LLRW after Dec. 31, 1992. Even with the 18-month reprieve from loss of access resulting from the new contract executed by the Board and the Southeast Compact Commission, the Board has encouraged LLRW generators to take whatever actions are necessary and appropriate, including modifications to their NRC possession licenses, to allow greater levels of activity to be stored on site if such storage becomes the only temporary option for LLRW management.

The Board would continue its action of urging generators to work with the NRC and other entities, as needed, to prepare their radioactive materials possession limits and their storage facilities for on-site storage.

4.4 Centralized Storage Facility Performance Plan

This option would mean a decision by the Management Board to site a centralized storage facility within the Commonwealth that would operate for at least five years, and longer if authorized by the licensing agency (NRC or DPH).

Although the Management Board determined on two occasions in 1991 that a centralized storage facility was not needed, due to the fact that LLRW generators can store their waste on site for the same (or approximately the same) period of time, public comments received during the comment period on the draft LLRW Management Plan suggested that the Board should carry the centralized storage option further, and provide the details in a "performance plan" of the steps involved in implementing this option.

As noted earlier in this chapter, a centralized storage site could be identified pursuant to all the siting steps in Chapter 111H, or such a facility could be developed using the "emergency" provisions of Chapter 111H, section 12 (i.e., the "interim or emergency" storage facility).

The decision points presented here relate to one or both of these possibilities. One way of instituting centralized storage is termed the "non-emergency" performance plan; the other is labeled the "interim and emergency" storage performance plan. When the steps differ, they are presented side-by-side for comparison.

Step #1 to Implement a Centralized Storage Facility Performance Plan: Determine Siting Process

As stated, a centralized storage facility could be developed using two quite different procedures. The Management Board would determine whether or not the need for such a facility was on an "interim or emergency" basis. If an emergency determination were made, the Board would proceed with siting following the provisions of Chapter 111H, section 12, and others that apply. If the Board determined that a centralized storage site could be developed on a "non-emergency" basis, it would proceed with siting according to the requirements of Chapter 111H, sections 19 through 24.

Step #2 to Implement an "Interim or Emergency" Centralized Storage or "Non-Emergency" Centralized Storage Facility Performance Plan: Notification

The Management Board would notify the Chief Executive Officer of every municipality in the Commonwealth, as required by Chapter 111H, of the Board's decision to commence the centralized storage facility siting process. The Management Board would also notify every community's Chief Elected Official,[2] statewide newspapers, radio and television stations, and other media outlets. The Board's Public Participation Coordinator and other Board staff would be available to attend meetings, conduct workshops, brief federal and state legislators and local officials, and generally to speak to interested groups about the storage facility siting process, answer questions, and listen to public concerns.

Step #3 to Implement an "Interim or Emergency" Centralized Storage or "Non-Emergency" Centralized Storage Facility Performance Plan: Siting Plan

With assistance from the Public Participation Coordinator, when facility siting is initiated, the Management Board would prepare a "siting plan" identifying the major decision points in the State's siting process, and summarizing the roles and responsibilities of state agencies and potential site communities. The plan would be made available to all interested parties.

Step #4 to Implement a Centralized "Interim and Emergency" Storage Facility Performance Plan: Modify and Finalize the Interim and Emergency Storage Plan

The Management Board's current Interim and Emergency Storage Plan would need to be amended to include a component on centralized interim and emergency storage. The Board would review its plan, and add necessary provisions, including a specification of the maximum length of time during which such a facility may be utilized.

Step #5 to Implement a Centralized "Interim and Emergency" Storage Facility Performance Plan: Voluntary Siting Stage

As part of the notification to municipal officials and others of a decision to site a centralized interim and emergency storage facility, the Management Board would encourage sites to be volunteered for such a facility.

Step #6 to Implement a Centralized

Step #4 to Implement a "Non-Emergency" Centralized Storage Facility Performance Plan: Voluntary Siting Stage

As part of the notification to municipal officials and others of a decision to site a "non-emergency" centralized storage facility, the Management Board would encourage sites to be volunteered for such a facility.

Step #5 to Implement a "Non-Emergency" Centralized Storage Facility Performance Plan: Grants to Evaluate Siting Effects

In the notification that the siting process has been initiated, the Management Board would inform municipalities and others of the availability of grant funds to evaluate the economic impacts of a storage facility.

Step #6 to Implement a "Non-Emergency" Centralized Storage Facility Performance Plan: Determine the Operational Period of the Storage

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[2] The "Chief Elected Official" of a municipality is the Mayor of any city, or the chairman of the Board of Selectmen in any town.

"Interim and Emergency" Storage Facility Performance Plan: Select Storage Facility Location; Announce Board's Role as Facility "Operator"

The Management Board would select a site after conducting a public hearing. The hearing would address site selection, facility licensing requirements, and the Board's role as facility operator.

Step #7 to Implement a Centralized "Interim and Emergency" Storage Facility Performance Plan: Retain Consultants for Site Studies

To ensure that the site meets licensing requirements, the Management Board would hire consultants to conduct site studies.

Step #8 to Implement a Centralized "Interim and Emergency" Storage Facility Performance Plan: Public Hearing on Draft Site Studies

The Management Board would conduct a public meeting for public review and comment on draft plans for site studies.

Step #9 to Implement a Centralized "Interim and Emergency" Storage Facility Performance Plan: Issue Draft Site Studies Report for Public Review

Following completion of on-site studies, the Management Board would issue for public review and comment a draft report describing the site investigation, conduct at least one public meeting on the draft report in the site community, and accept written comments from interested persons.

Step #10 to Implement a Centralized "Interim and Emergency" Storage Facility Performance Plan: Management Board Action to Accept, Facility, and Calculate its Size

The Management Board would initiate discussions with the licensing agency, either NRC (if Massachusetts is not an Agreement State), or DPH (if Agreement State status has been approved), to determine the number of years such a storage facility could be licensed to operate. Once the operational period is determined, the Board would calculate the facility size.

Step #7 to Implement a "Non-Emergency" Centralized Storage Facility Performance Plan: Consider Contracting to Accept Out-of-State LLRW for Storage

The Management Board may determine that some of the capacity in the centralized storage facility should be made available to generators in other states, in order to obtain additional revenues to operate the facility and finance closure, post-closure operations and maintenance, and institutional control costs. The Board would evaluate the economic, environmental, transportation, political, and other impacts of accepting out-of-state waste for storage. Hearings would be conducted to hear public opinion.

Steps #8 through #32 to Implement a "Non-Emergency" Centralized Storage Facility Performance Plan: Proceed with the Identically Numbered Steps in the "Disposal Facility Siting Performance Plan"

The next 25 steps to implement a non-emergency centralized storage facility plan are the same as those of the steps to implement a disposal facility siting plan, as required by Chapter 111H. They are fully described in Section 4.5 of this chapter, and are summarized here as follows:

Step #8: Retain siting consultants to conduct the site selection process.

Step #9: Issue Statewide Mapping and Screening Report, identifying and excluding those areas of the State that appear to be unable to satisfy

Amend, or Reject Draft Site Studies Report

Following a public hearing, the Management Board would vote to accept, amend, or reject the draft site studies report. If the Board were to reject the report, it would be set aside, and the procedures identified in steps #1 through #9 would be repeated.

Step #11 to Implement a Centralized "Interim and Emergency" Storage Facility Performance Plan: Adoption by Board of Centralized Storage Site

If the Management Board accepts the draft site studies report, it may proceed to adopt the site for a centralized interim and emergency storage facility.

Step #12 to Implement a Centralized "Interim and Emergency" Storage Facility Performance Plan: Acquiring the Site

The Management Board would acquire the appropriate property interest in the site. Depending upon what agency would be licensing the site, the Management Board would have to determine the pertinent property interest.[3]

(The remaining steps in the "Interim and Emergency" storage performance plan appear on Page 4-12.)

the site selection criteria. Conduct public hearings to allow for public review and comment on the mapping and screening report.

Step #10: Identify possible locations that are likely to contain one or more "candidate" sites for a storage facility.

Step #11: Issue a Possible Locations Report for public review and comment.

Step #12: Identify between two to five candidate sites which initial data suggest would best satisfy the site selection criteria.

Step #13: Issue a Draft Candidate Sites Identification Report for public review and comment.

Step #14: Submit the draft report to the Secretary of Environmental Affairs for an evaluation of the report's technical adequacy and conformance with the siting criteria.

Step #15: Announce plans to conduct detailed site characterization.

Step #16: Accept or amend the draft report and proceed with detailed site characterization, or reject the draft report and repeat earlier siting steps to select new candidate sites.

Step #17: Transmit copies of the Draft Candidate Sites Identification Report to the libraries of all impacted communities.

Step #18: Announce the property value protection program.

Step #19: Acquire a determinable property interest in each candidate site in order to conduct detailed site characterization of each candidate site.

Step #20: Establish Community Supervisory Committees (CSC) to represent the candidate site communities' interests during site characterization.

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[3] If the licensing entity is the NRC, the Commonwealth would not have to own the site. On the other hand, if the licensing authority is DPH, the Management Board would be required to purchase the site, pursuant to DPH licensing regulations.

Step #21: Issue a request for proposals (RFP) for the development, operation, closure, and post-closure observation and maintenance of a storage facility.

Step #22: Attorney General's office to investigate each company responding to the RFP.

Step #23: Certify those applicants for facility operator that satisfy the Management Board's regulations pertaining to financial, technical, and management criteria for operator selection.

Step #24: Execute contracts with all certified operator applicants to ensure their participation in an advisory board to assist in planning and implementing detailed site characterization.

Step #25: CSCs assist the Board to develop detailed site characterization plans for each candidate site.

Step #26: CSCs and Board jointly conduct public meetings to receive public comment on draft characterization plans.

Step #27: Following year long, four-season, detailed site characterization of each candidate site, issue a Draft Detailed Site Characterization Report for public review and comment.

Step #28: Transmit draft report to Secretary of Environmental Affairs for an evaluation of the report's technical adequacy and conformance with the siting criteria.

Step #29: Conduct public hearing prior to Management Board vote to accept, amend, or reject the Draft Detailed Site Characterization Report. If the report is rejected, the detailed site characterization would be repeated.

Step #30: If the report is accepted, the Management Board may vote to select a superior site.

Step #31: Any person aggrieved by the site selection process may petition DEP for an adjudicatory hearing.

Step #32: The Management Board would acquire the superior site.

Step #13 to Implement a Centralized "Interim and Emergency" Storage Facility, and Step #33 to Implement a "Non-Emergency" Centralized Storage Facility Performance Plan: Improving the Safety or Efficiency of Storage Technologies and Practices

The Management Board has made a number of recommendations to improve the safety or efficiency of storage, which are listed in Chapter 5 of this volume, and are described in Chapter 12 of VOLUME II. Those that apply to LLRW storage in a centralized facility include:

(1) Storage methods that increase the potential for environmental or public health damage -- such as storage outside in a manner that exposes waste packages to changes in climate -- will be discouraged.

(2) All waste requiring interim or long-term storage should be packaged in ways that ensure environmental and public health protection. In planning for storage, LLRW generators need to be cognizant that packaging, treatment, and disposal standards could possibly be modified during a storage period, thereby requiring LLRW to be repackaged for ultimate disposal. To assist generators with these issues, the Commonwealth should make available technical assistance on storage problems.

(3) Any LLRW stored in a centralized storage facility, that may later require repackaging for disposal, will be the financial responsibility of the generator.

(4) Storage for longer than the current maximum storage period (i.e., five years) will be encouraged only after all potentially troublesome waste has been processed for reasonable stability; and all treatable waste has been processed to achieve reasonable volume-reduction levels.

(5) The Commonwealth should provide an adequate number of qualified personnel in the DPH Radiation Control Program to ensure its capability to perform necessary inspection and enforcement activities at any centralized storage facility.

Step #14 to Implement a Centralized "Interim and Emergency" Storage Facility, and Steps #34 to Implement a "Non-Emergency" Centralized Storage Facility Performance Plan: Enhancing LLRW Transport

The potential impacts of transporting LLRW to an in-state centralized storage facility would be evaluated through the siting process. In addition, the following actions would be taken:

(1) The Management Board would encourage the Massachusetts Emergency Management Agency (MEMA), the State Police, DPH, and other appropriate state agencies to plan, train for, and execute LLRW shipment emergency response "exercises." Such exercises would improve the technical quality of emergency response procedures, and increase public confidence in the response system.

(2) While any potential centralized storage site is undergoing site characterization or studies necessary to fulfill licensing requirements, the Management Board would develop estimates of the number of LLRW shipments as well as non-radioactive traffic associated with facility operation, and would plan traffic controls to minimize potential traffic problems.

(3) The Management Board would conduct an LLRW transportation risk analysis to evaluate potential radiological risks from LLRW transportation to drivers, facility employees, and the public.

(4) If the centralized storage facility were to be a regional site, the Management Board would encourage DPH to work with appropriate regulatory agencies from the states in the region, to coordinate inspections of LLRW shipments.

Step #15 to Implement a Centralized "Interim and Emergency" Storage Facility and Step #35 to Implement a "Non-Emergency" Centralized Storage Facility Performance Plan: Facility Insurance

The Management Board would conduct a financial risk assessment to evaluate the potential hazards involved, the financial risks associated with those hazards, and the insurance or other financial mechanisms available to provide the necessary protection for a centralized storage facility. The same types of insurance identified in Step #35 of the "Disposal Facility Siting Performance Plan" (i.e., Comprehensive General Liability, Environmental Impairment Liability and Nuclear Energy Liability) would be required, but the maximum limits would be determined with a consideration of the specific centralized storage activities anticipated.

4.5 Disposal Facility Siting Performance Plan

This is the last of the four options for the Management Board to consider in assessing implementation strategies for the determination of need for disposal capacity. This option involves the identification of several potential, or "candidate" sites within the Commonwealth, following statewide environmental screening to eliminate all lands that appear to be environmentally unsuitable. It includes the provision for year-long, four-season, detailed site characterization to collect data for further review and consideration, in order to select a "superior" site for a disposal facility.

The decision points summarized here are all requirements of Chapter 111H, with the exception of additional policies adopted by the Board, and listed in Chapter 5 of this volume. The steps summarized here relate only to the phase of siting an LLRW disposal facility; they do not include the additional steps related to licensure, facility site development, operation, closure, etc.

Step #1 to Implement a Disposal Facility Siting Performance Plan: Notification

The Management Board would notify the Chief Executive Officer of every municipality in the Commonwealth, as required by Chapter 111H, of the Board's decision to commence the disposal facility siting process. The Management Board would also notify every community's Chief Elected Official, statewide newspapers, radio and television stations and other media outlets. The Board's Public Participation Coordinator and other Board staff would be available to attend meetings, conduct workshops, brief federal and state legislators and local officials, and generally to speak to interested groups about the disposal facility siting process, answer questions, and listen to public concerns.

Step #2 to Implement a Disposal Facility Siting Performance Plan: Voluntary Siting Stage

As part of the notification to municipal officials and others of a decision to initiate siting for a

disposal facility, the Management Board would inform community leaders of the "voluntary" siting stage of the process, and encourage them to participate.

After the Board completed its first statewide screening to eliminate potentially unsuitable areas of the Commonwealth, and had issued its Statewide Mapping and Screening Report, all municipalities with possible locations still under consideration would receive a second notice of the voluntary siting program, as well as information about the availability of compensation and facility impact funds, and would be encouraged to participate. Any "volunteered" sites would continue to be evaluated as long as they met the site criteria for candidate sites. Any "volunteered" sites which fail the environmental screening process would be eliminated from consideration.

Step #3 to Implement a Disposal Facility Siting Performance Plan: Grants to Evaluate Siting Effects

In the notification to every city and town that the siting process has been initiated, the Management Board would inform municipalities and others that grant funds would be available to those who may be interested in possibly volunteering a site, after the issuance of the Statewide Mapping and Screening Report. Grants would be provided by the Management Board to enable communities to evaluate the potential economic impacts of having an LLRW disposal facility within their borders.

At the same time, municipalities and others would be informed that the siting process would evaluate the entire state, in order to identify the most suitable "candidate" sites for further analysis.

Step #4 to Implement a Disposal Facility Siting Performance Plan: Determine the Type and Size of Disposal Facility

Four disposal facility siting options are described in Chapters 13 and 15 of VOLUME II. The Management Board would consider each, and choose among them or some variation, if annual survey data revealed any different projections of waste volume than currently anticipated by the Board. The four facility size options are:

(1) Site a disposal facility for Massachusetts-only LLRW (approximately 35,000 cubic feet per year).

(2) Site a disposal facility for Massachusetts-only LLRW (approximately 50,000 cubic feet per year).

(3) Site a small regional disposal facility that would handle LLRW from Massachusetts and one or more neighboring states (approximately 80,000 cubic feet per year).

(4) Site a large regional disposal facility to accommodate LLRW from the New England states as well as other states searching for disposal options (approximately 467,000 cubic feet per year).

Step #5 to Implement a Disposal Facility Siting Performance Plan: Prepare a "Siting Plan"

With assistance from the Public Participation Coordinator, when facility siting is initiated, the Management Board would prepare a "siting plan" identifying the major decision points in the State's siting process, and summarizing the roles of responsible state agencies and potential site communities. The plan would be made available to all interested parties.

Step #6 to Implement a Disposal Facility Siting Performance Plan: Select Compacting or Contracting

If the Management Board makes a decision to site a regional facility, the Commonwealth would have to decide whether all party states that would use the regional site would be legally bound through a regional "compact" or through a "contract." In the case of a "compact," all participating states' Legislatures would have to adopt an identical law establishing the rights and obligations of the host and party states; that law would then require approval by Congress. If a decision were made to enter into a "contractual" agreement with other states, rather than to follow the "compact" route, legal decisions would be necessary to develop and implement a workable contract.

There are legal questions relating to compacting, as opposed to a "Massachusetts-only facility." For example, the issue of whether a "go-it-alone" state could, under any circumstances, exclude waste from outside the state, merits further legal review.

If a decision were made to site a regional facility in Massachusetts, much or all of the pre-development (siting) costs would come from the non-host states selected to utilize the disposal site.

Step #7 to Implement a Disposal Facility Siting Performance Plan: Choose the States to Join a Regional Compact or Contract

If the Management Board determines that a regional disposal facility should be sited within the Commonwealth, after evaluating the legal implications of compacting or contracting and choosing one of those options, the Board would select the states with which to enter into a compact or contractual association. Compact legislation would be prepared for submission to each state's Legislature, or contract documents prepared, while site identification activities were underway.

Step #8 to Implement a Disposal Facility Siting Performance Plan: Retain Siting Consultants

Consultants would be hired by the Management Board as necessary, to complete the site selection process. That process would involve screening the entire State to eliminate lands that would appear not to meet the DEP siting criteria regulations. Consultant selection would be competitive and follow state procurement regulations.

Step #9 to Implement a Disposal Facility Siting Performance Plan: Issue Statewide Mapping and Screening Report for Public Review

Using existing data from the Massachusetts Geographic Information System (GIS) -- the State's computer-based information handling program that can store and manipulate both map-based information and associated tabular data such as population density -- and from other state, federal, regional, and local sources, the Management Board would issue a report of its statewide mapping and screening activities for public review and comment at public hearings. The report would identify and exclude from the siting process, those areas of the State that appear to be unable to satisfy the DEP site selection criteria.[4]

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[4] The intent of each stage of environmental screening is to exclude from further consideration areas that appear not to meet the siting criteria. It should be noted, however, that in the situation that would require the Board to start the siting process anew, the potential exists that areas which were "excluded" once, may not be excluded the second time around.

Step #10 to Implement a Disposal Facility Siting Performance Plan: Identify Possible Siting Locations

Using the areas in the State that remain under consideration in the Statewide Mapping and Screening Report, the Management Board and its consultants would identify possible locations that are likely to contain one or more "candidate" sites.

Step #11 to Implement a Disposal Facility Siting Performance Plan: Issue Possible Locations Report for Public Review

The Possible Locations Report would identify the potential locations that appear to satisfy the site selection criteria, and describe the procedures used to identify such locations. At least one public hearing would be conducted in the vicinity of each possible location. The notice of the public hearing would be sent to each community Chief Executive Officer and each municipal Chief Elected Official, detailing siting and other LLRW management activities.

Step #12 to Implement a Disposal Facility Siting Performance Plan: Identify Candidate Sites

Using information, including "local knowledge," from the preliminary screening of areas within the possible locations earlier identified, the Management Board would identify between two and five candidate sites which initial data suggest would best satisfy the site selection criteria, would be potentially licensable, capable of being developed, and otherwise appropriate to undergo detailed site characterization.

Step #13 to Implement a Disposal Facility Siting Performance Plan: Issue Draft Candidate Sites Identification Report for Public Review

The Draft Candidate Sites Identification Report would identify the candidate sites, and describe the procedures used to select them. The report would be publicized widely for public review and comment, and a public hearing would be held in each candidate site community. In addition, the Board would consider and evaluate all comments, both from the public hearing and those submitted in writing after the hearing, prior to accepting the Draft Candidate Sites Identification Report.

Step #14 to Implement a Disposal Facility Siting Performance Plan: Transmit Draft Candidate Sites Identification Report to the Secretary of EOEA

At the same time that the Management Board releases the Draft Candidate Sites Identification Report to the public, and widely publicizes its availability for public review and comment, the Board would transmit a copy of the report to the Massachusetts Secretary of the Executive Office of Environmental Affairs (EOEA). The Secretary would implement the public review and comment procedures required by the Massachusetts Environmental Policy Act (MEPA), and would issue a statement evaluating the draft report's technical adequacy and conformance with the DEP siting criteria regulations applicable to LLRW facilities.

Step #15 to Implement a Disposal Facility Siting Performance Plan: Notice to Local Officials

The Board and the Commissioner of the Division of Capital Planning and Operations (DCPO) would notify local officials of the Commonwealth's intention to conduct detailed site characterization. A public hearing would be conducted in each candidate site community.

Step #16 to Implement a Disposal Facility Siting Performance Plan: Management Board Determination on Draft Candidate Sites Identification Report

The Management Board would vote to accept or amend the Draft Candidate Sites Identification Report and proceed to conduct detailed site characterization of the candidate sites identified in the report, as accepted or amended, or reject the draft report and repeat the earlier steps in the siting process to identify new candidate sites.

Step #17 to Implement a Disposal Facility Siting Performance Plan: Additional Public Notification

If the Management Board votes to proceed with detailed site characterization, the Board would send copies of the Candidate Sites Identification Report to all municipal libraries of impacted communities.

Step #18 to Implement a Disposal Facility Siting Performance Plan: Institute Property Value Protection Program

The Management Board would implement its property value protection program designed to ensure that property owners near all candidate sites would receive a pledge, and property owners near the "superior site"[5] (if selected) would have a guarantee, of protection from the loss of property value if they sold their property within five years after a facility were licensed.

Step #19 to Implement a Disposal Facility Siting Performance Plan: Acquiring a Determinable Property Interest in Each Candidate Site

If the Management Board votes to conduct detailed site characterization, the Commonwealth would take action to acquire a determinable property interest in each candidate site, or, if the candidate site were property owned by the Commonwealth, to transfer the control and use of such property to the Management Board. The property interest would have to be adequate to permit the conduct of detailed site characterization, and to restrict the right to develop the property until a facility license is issued.

Step #20 to Implement a Disposal Facility Siting Performance Plan: Establish Community Supervisory Committees

At the same time that the Draft Candidate Site Identification Report has been issued for public review and comment, the Management Board would request that the Chief Executive Officer (CEO) of each community in which is located all or a part of a candidate site, establish a Community Supervisory Committee (CSC) for each community. If a CSC were not appointed by the CEO, the Management Board would designate a committee to assume the CSC's responsibilities until a CSC were established.

Step #21 to Implement a Disposal Facility Siting Performance Plan: Issue RFP for Facility Development, Operation, Closure, and Post-Closure Observation

The Management Board would issue a request for proposals (RFP) for the development, operation, closure, and post-closure observation and maintenance of a disposal facility. Companies responding to the RFP would be required to pay the Management Board a fee of not less than $10,000 at the time they submit responses to the RFP, and to specify how they would participate in an advisory board to assist in the

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[5] A "superior site" is any site selected by the Management Board, following detailed site characterization.

planning and implementation of detailed site characterization.

Step #22 to Implement a Disposal Facility Siting Performance Plan: Attorney General Investigative Report on Each RFP Respondent

The state Attorney General would submit to the Management Board and all CSCs a report on his investigation of each company applying for consideration to develop, operate, and close a disposal facility. The report would describe each company's record of compliance with environmental and related laws, regulations, permits, and licenses, both inside and outside of Massachusetts.

Step #23 to Implement a Disposal Facility Siting Performance Plan: Certification of Applicants as Potential Facility Operators

After the issuance of the Draft Candidate Site Identification Report, the Management Board would certify those applicants for consideration as facility operator that satisfy the Management Board's regulations pertaining to financial, technical, and management criteria for operator selection. The Board would issue a report justifying its certifications, and distribute this report to each CSC, the applicants, and others of interest. If any operator applicant were to propose more than one disposal technology, the Management Board would certify each individually, for use by the CSC in their review of operator applicants and their selection (simultaneously) of the facility operator and disposal technology.

Step #24 to Implement a Disposal Facility Siting Performance Plan: Contract with Operator Applicants

The Management Board would execute contracts with all certified operator applicants to ensure their participation in an advisory board to assist in planning and implementing detailed site characterization.

Step #25 to Implement a Disposal Facility Siting Performance Plan: Develop Detailed Site Characterization Plans

Each CSC would assist the Management Board in developing a Detailed Site Characterization Plan for each candidate site, and participate throughout the implementation of the plan. CSCs would be kept informed of the progress of detailed site characterization, meet monthly with representatives of the Board and the Board's siting consultants, be furnished copies of all data, reports, and memoranda pertaining to detailed site characterization activities, and be given opportunities for review and comment.

Step #26 to Implement a Disposal Facility Siting Performance Plan: Public Hearing on Draft Plan for Detailed Site Characterization

The CSC and the Board would jointly conduct a public meeting to discuss the draft plan for detailed site characterization. Prior to its adoption of the final Detailed Site Characterization Plan for each candidate site, the Board would consider and evaluate all comments made at the public meeting or in writing.

Step #27 to Implement a Disposal Facility Siting Performance Plan: Issue Draft Detailed Site Characterization Report for Public Review

Following the year-long, four-season detailed site characterization of each candidate site, the Management Board would issue a Draft Detailed Site Characterization Report on each candidate site for public review and comment. The Board would conduct at least one public meeting on the draft report in each candidate site community, and accept written comments on the report from the CSC and other

interested persons.

Step #28 to Implement a Disposal Facility Siting Performance Plan: Transmit Draft Detailed Site Characterization Report to the Secretary of EOEA

At the same time that the Board issues the Draft Detailed Site Characterization Report, it would transmit a copy of the report to the Commonwealth's Secretary of Environmental Affairs (EOEA). The Secretary would implement the public review and comment procedures required by MEPA, and issue a statement evaluating the report's technical adequacy and conformance with the DEP's LLRW facility siting criteria regulations. The Secretary would transmit a copy of this statement to the Board and the CSCs.

Step #29 to Implement a Disposal Facility Siting Performance Plan: Management Board Determination on Draft Detailed Site Characterization Report

The Management Board would hold a public hearing prior to its vote to accept, amend, or reject the Draft Detailed Site Characterization Report. If the Board were to reject the draft report, it would be set aside, the procedures relating to detailed site characterization would be repeated, and the Board would meet with each CSC to discuss a draft plan for implementing a revised detailed site characterization process.

Step #30 to Implement a Disposal Facility Siting Performance Plan: Vote to Select Superior Site

The Management Board may vote, by two-thirds of its members, to select a superior site for a facility if the Board has first accepted a Detailed Site Characterization Report.

Step #31 to Implement a Disposal Facility Siting Performance Plan: Adjudicatory Proceeding

If any person aggrieved by the site selection process were to petition the DEP within 30 days after selection of a superior site, the Commissioner of DEP would commence an adjudicatory proceeding concerning site selection. In addition to the petitioner, the Management Board, the site, and neighboring communities[6] would be parties to the adjudicatory proceeding, and other aggrieved individuals or groups could intervene. The expenses of the site and neighboring communities to participate in the adjudicatory proceeding would be reimbursed by the Management Board.

Any person aggrieved by the DEP Commissioner's decision could seek judicial review in the Massachusetts Supreme Judicial Court.

Step #32 to Implement a Disposal Facility Siting Performance Plan: Acquiring the Site

Upon a vote by the Management Board to select a superior site, the State would acquire a fee simple interest in the superior site, together with such other land, easements, rights-of-way or other property interests necessary to construct and operate an LLRW disposal facility. If the site were on property owned by the State, actions would be taken to transfer control and use of the property to the Management Board.

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[6] A "site community" is a community in which is located all or any part of any superior site. A "neighboring community" is a municipality, other than a site community, which has at least 20% of its population residing within three miles of any superior site.

Step #33 to Implement a Disposal Facility Siting Performance Plan: Improving the Safety or Efficiency of Disposal Technologies and Practices

The site community, not the Commonwealth, would select the type of technology (i.e., above-ground vaults, below-ground vaults, above-ground canisters inside vaults, etc.) for any LLRW disposal facility sited, developed, operated, and closed in accordance with Chapter 111H. Regardless of the disposal method chosen, the Management Board has made a number of recommendations to improve the safety or efficiency of such a facility, which are listed in Chapter 5 of this volume, and are further discussed in Chapter 13 of VOLUME II. They include:

(1) The Management Board would provide technical assistance to potential disposal facility site communities in order to help them evaluate LLRW disposal technologies and practices, and their suitability at each candidate site location.

(2) Chapter 111H requires that conditions under which waste would be accepted into a Massachusetts disposal facility must be reviewed by the Management Board yearly. As part of such review, the Board would continuously evaluate such factors as waste form, stability, and potential pre-treatment requirements, in order to enhance the facility's ability to (a) safely dispose of LLRW, (b) keep radiation exposures as low as reasonably achievable, and (c) operate the facility in a manner most protective of the public health, safety, and the environment.

(3) In considering waste form, stability, and other factors pertaining to waste acceptance criteria, the Board needs to evaluate the implications of approving waste acceptance criteria that could result in concentrating the amount of activity in the waste, and thereby moving some LLRW out of Class A, B, or C, and into the Greater than Class C (GTCC) waste category. While GTCC waste disposal is the responsibility of the federal government, it has not yet succeeded in siting a facility for this waste. The Management Board should monitor the federal government process to establish such a GTCC facility, recognizing that Board actions regarding waste acceptance criteria at a Massachusetts-based disposal facility could impact the GTCC waste issue.

(4) Waste would be segregated in a disposal facility by short and long radioactive half-life in order to enhance the safety and efficiency of any retrieval activity that may later be required.

(5) Appropriate monitoring systems would be installed to monitor both below and adjacent to each disposal unit, in order to immediately detect any radionuclide movement.

(6) Because disposal of Class C waste poses the greatest long-term potential radiological threat, consideration would be given to requiring additional barriers, including packaging, for Class C waste disposal, besides those provided by the disposal facility technology.

(7) Remedial action plans, containing basic policies for remediating general categories of potential contamination incidents, would be prepared and approved as part of the comprehensive operating contract, prior to operation, in the unlikely event of a contamination incident.

(8) A plan for disposing of water, soil, and other materials collected during monitoring and sampling would be prepared and submitted for approval prior to operation. It may be appropriate for this plan to be incorporated into the comprehensive operating contract.

(9) The comprehensive operating contract would include provisions for: (a) employing methods

during facility operation to force water to drain away from disposal units; and (b) not placing waste packages into disposal units during adverse weather conditions, unless methods are followed to prevent rainwater entry into the units.

(10) The Management Board would carefully evaluate all disposal fees to ensure that the contingent liability and institutional control accounts within the Low-Level Radioactive Waste Trust Fund would contain enough funds to (a) properly maintain the facility throughout the institutional control period; (b) provide for compensation for injuries to persons, land or property; and (c) provide sufficient funds for decommissioning, in the event the site were to be closed prematurely.

Step #34 to Implement a Disposal Facility Siting Performance Plan: Enhancing LLRW Transport

The potential impacts of transporting LLRW to an in-state disposal facility would be evaluated throughout the siting process, both through DEP's facility siting criteria and through MEPA reviews built into the siting process. In addition to the evaluation of transportation impacts, the following actions would be taken:

(1) The Management Board would encourage the Massachusetts Emergency Management Agency (MEMA), the State Police, DPH, and other appropriate state agencies to plan, train for, and execute LLRW shipment emergency response "exercises." Such exercises would improve the technical quality of emergency response procedures, and increase public confidence in the response system.

(2) While candidate sites were undergoing detailed site characterization, the Management Board would develop estimates of the number of LLRW shipments, as well as non-radioactive traffic associated with facility operation, that could occur at each potential site during a given timeframe, and would plan traffic controls to minimize any potential traffic problems.

(3) The Management Board would conduct an LLRW transportation risk analysis to evaluate potential radiological risks from LLRW transportation to drivers, facility employees, and the public.

(4) If the disposal facility were to be a regional site, the Management Board would encourage DPH to work with appropriate regulatory agencies from the states in the region to coordinate inspections of LLRW shipments.

Step #35 to Implement a Disposal Facility Siting Performance Plan: Facility Insurance

The Commonwealth would follow the lead of other states that are developing LLRW disposal facilities and incorporating strict requirements for financial mechanisms to ensure defense and payment of third-party claims as well as the clean-up of a contaminated site, if such were to occur. The Management Board would require a facility operator to purchase the following insurance plans:

(1) All-Risk Property insurance to insure the facility itself (including costs of replacing buildings and equipment) in an amount equal to the facility's replacement costs, or the maximum amount available, whichever is less;

(2) Comprehensive General Liability insurance with minimum limits of $25 million dollars per

occurrence and $25 million in the aggregate;

(3) Environmental Impairment Liability insurance with minimum limits of $10 million, or such greater amounts, up to the maximum loss potential determined by a risk assessment acceptable to the Management Board, as may from time to time be commercially available; and

(4) Nuclear Energy Liability Insurance, with minimum limits equal to $25 million or the maximum loss potential determined by a risk assessment acceptable to the Management Board. The Board would require the facility operator to agree to use its reasonable best efforts to obtain such insurance at the required amount. Since such insurance is not currently available in amounts over $25 million, the operator would alternatively be required, through a letter of credit or other acceptable means, to establish an escrow arrangement equal to the difference between the available nuclear energy liability insurance policy limits and the required insurance amount.

Chapter 5: Recommendations for LLRW Management

5.1 Introduction

Four performance plan options have been described in the preceding chapter that provide the Commonwealth choices to implement the finding of a need for an LLRW disposal facility, an LLRW storage facility (to fulfill the need that will occur at the latter part of this decade), but no treatment facilities to manage LLRW generated in Massachusetts at the present time and through the next decade. These strategic options, are, themselves, recommendations for action. Now that the "draft" Management Plan and associated regulations have been adopted by the Management Board, and the LLRW-related regulations of DPH and DEP have also been adopted, the Management Board will select one or more of these options for implementation. A public hearing will precede the Board's selection of the implementation strategy (or strategies) chosen.

Other recommendations will also be implemented as part of the fulfillment of this adopted Management Plan. All recommendations contained in this Plan are listed below. Recommendations #1 through #11 will be implemented regardless of the action plan chosen by the Management Board. Recommendations #12 through #23 augment the performance plan(s) for storage as disposal facility siting, depending upon the performance plan(s) selected. Recommendation #24 addresses the use of incineration if any treatment capacity is later determined to be needed, that would require the siting of an LLRW treatment facility within the Commonwealth. The final recommendation, #25, pertains to insurance requirements for LLRW treatment or storage facilities, if such facilities are ever sited.

5.2 LLRW Management Recommendations

Background information and justification for each of the recommendations is contained within VOLUME II of this Management Plan. Chapter 6 of this volume summarizes the major issues that were evaluated by the Management Board, which are described in detail in all the chapters of VOLUME II, and which led to the following recommendations.

Management Plan Recommendation #1: Public Involvement in LLRW Management

Numerous statutory provisions for public participation that are contained in Massachusetts General Laws c. 111H (Chapter 111H) are detailed in Chapter 5 of VOLUME II, along with the following recommendations:

(1) All agencies of the Commonwealth responsible for various aspects of LLRW management should communicate to the public with honesty, consistency, competency, and fairness.

(2) No studies or other documents which are public records under state law will be kept

confidential relevant to the implementation of the Management Plan. The State's public records law exempts certain materials from designation as "public records." These include records related to personnel rules, personnel and medical files, personal employee notes, etc.

(3) The Management Board will continue to implement its Public Participation Plan, which identifies policies and procedures for citizen involvement.

Management Plan Recommendation #2: Waste Classification by "Total Hazard"

A system has been developed to classify LLRW produced in Massachusetts in terms of its "total hazard" regarding radiological, chemical, and biological toxicity and form (liquid or solid), radioactive half-life, chemical reactivity, and volume, etc. This system will be utilized in the "total management" of LLRW, i.e., not just in disposal, but also in any storage, treatment, or disposal facilities sited and developed in accordance with Chapter 111H.

Management Plan Recommendation #3: Agreement State Program

The Commonwealth should enter into an agreement with the U.S. Nuclear Regulatory Commission (NRC) for DPH to assume regulatory control over the users of radioactive materials and generators of LLRW, and any LLRW storage, treatment, or disposal facilities which may be developed pursuant to the requirements of Chapter 111H. Such a regulatory program will require the State, rather than the NRC, to license, inspect, and enforce regulations with respect to radioactive materials users and LLRW facilities developed by the Commonwealth.

The Commonwealth currently has a contract that allows Massachusetts LLRW generators to ship their waste for disposal to Barnwell, South Carolina. When that contract ends on June 30, 1994, generators will be required to store their LLRW on site, until a disposal solution is available.[1] Such storage will occur at more than 200 storage sites around Massachusetts. In addition to all the other public health benefits of Agreement State status, this program will give the Commonwealth the means to ensure that LLRW will not pose public health, safety, or environmental threats while stored on site for an interim period of years, prior to the Commonwealth achieving a long-range disposal solution.

In July, 1992, Governor William F. Weld officially applied to the NRC to have Massachusetts become an Agreement State. The program review and approval process, which is described in detail in Chapter 2 of VOLUME II, is expected to take a year or more for the NRC to complete.

Management Plan Recommendation #4: Minimizing Radioactive Sources and LLRW Volumes

Technologies and practices to reduce or eliminate, where possible, the sources of radioactive materials that can produce LLRW, and to minimize the volume of LLRW as well, are important policies in the management of LLRW. In Massachusetts, source and waste volume minimization is required by state law; a program to achieve these goals can be implemented once the State becomes an Agreement State. The regulatory agency would be DPH.

It is recommended that DPH implement a regulatory program which:

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[1] Some LLRW may be accepted at the Envirocare of Utah site in Clive, Utah. That disposal site is limited by its license to accepting low-activity LLRW and low activity mixed waste. Envirocare cannot solve the Commonwealth's entire LLRW disposal problem.

(1) promotes and coordinates information exchanges among LLRW generators on the technical aspects of minimization technologies and procedures;

(2) provides an educational outreach program element to assist the public, media, policy-makers and others to evaluate source and LLRW volume minimization and elimination, where feasible, from a position of knowledge; and

(3) encourage policy development, planning, and implementation of source and waste elimination and minimization strategies.

The Management Board recommends that the DPH program emphasize source minimization and elimination over activities involving LLRW minimization. The Board also suggests that the minimization program require the substitution of short-lived radionuclides for long-lived nuclides, whenever possible. In addition, the Board recommends that the DPH program regulations include language supporting the Chapter 111H policy against "below regulatory concern" (BRC).

The program should involve radioactive materials users, persons with professional training and experience in environmental protection, and others qualified to provide advice on the implementation of the DPH minimization program and to evaluate its effectiveness. The program should be coordinated with the State's Office of Technical Assistance, a group of technical experts who are implementing the Toxic Use Reduction Act (TURA) mandate to aid hazardous waste generators identify and achieve new methods and technical processes for reducing toxic chemical wastes in the workplace.

The regulatory aspect of a minimization program should concentrate on the Chapter 111H requirement that every LLRW generator "prepare and implement plans for the utilization of all appropriate source minimization, volume minimization, and storage for decay methods." [Chapter 111H, section 13] Each minimization plan should be required at least once every five years, and be updated yearly, as necessary, through responses to the Commonwealth's annual radioactive materials users survey instrument.

Standardized forms should be prepared by DPH to enable LLRW generators to quickly and succinctly prepare various elements of their minimization plans.

Management Plan Recommendation #5: Improving the Safety or Efficiency of Treatment Technologies and Practices

Because LLRW treatment may make waste safer for other management steps, amenable for recovery, convertible to another usable material, or reduced in volume, the Management Board will:

(1) encourage LLRW treatment as appropriate in consideration of the public health, environmental, and economic impacts which treatment technologies and practices can effect.

(2) The Commonwealth recognizes the possible negative impacts on health, safety, and the environment of using treatment technologies and practices. However, the Commonwealth should educate the public that treatment technologies and practices can create potential risks of occupational and public exposure for the short-term, in contrast to the long-term problems that untreated and unstabilized waste could cause within an LLRW disposal facility.

(3) In addition to treatment to minimize radioactive sources and LLRW, treatment should be encouraged for the purpose of stabilizing LLRW, especially as the state approaches a time when all waste generated in the Commonwealth will require on-site storage due to the lack of available disposal facilities.

(4) In encouraging and promoting elimination (where feasible), minimization and stabilization, Massachusetts should serve as a resource to assist LLRW generators, to provide for technology exchanges, and to provide information to interested parties on the favorable effects of LLRW treatment. Such assistance could be provided by a number of agency sources: the DPH, the TURA Office of Technical Assistance, or the Management Board.

(5) The Commonwealth should encourage Massachusetts LLRW generators to utilize properly-licensed out-of-state treatment facilities, whenever appropriate.

(6) Climatic, geologic, and hydrogeologic considerations are relevant to siting a centralized treatment facility and the analysis each LLRW generator should undertake to evaluate various on-site treatment technologies and practices.

(7) The Commonwealth should provide an adequate number of qualified personnel and adequate funding support in DPH to ensure the agency's capability to conduct inspections and enforce regulations regarding treatment technologies and practices, once Massachusetts becomes an Agreement State and the DPH assumes regulatory authority.

(8) When Massachusetts becomes an Agreement State and assumes NRC regulatory authority over all radioactive materials users (with the exception of university research reactors, the nuclear-powered utility companies, and federal government licensees), the Management Board will fulfill its responsibilities under section 7 of St. 1987 c.549. That law provides a procedure for the Board to review applications from radioactive materials users wishing to amend their licenses to possess, use, store, treat, or dispose of, radioactive materials (and LLRW) -- in order for the Board to determine whether the proposed license amendments are "consistent" with the Management Plan. Because Chapter 549 refers to licenses issued by DPH -- and not NRC, this Act is operative only if Massachusetts is an Agreement State, and applies only to license amendments proposed after December 8, 1987, the date Chapter 111H took effect.

Management Plan Recommendation #6: Mixed Waste Management

Radioactive waste that has a toxic chemical component or exhibits hazardous waste characteristics is called "mixed waste." Its volume generated in Massachusetts is small. However, because of regulatory uncertainty between the two federal agencies (NRC and the U.S. Environmental Protection Agency -- EPA) charged with controlling this waste, much of the mixed waste generated cannot be stored on site legally, some of the mixed waste has no available commercial treatment, and only the Envirocare facility in Clive, Utah (which is limited by its license to disposal of certain types of mixed waste), can accept it for disposal.

The following recommended actions by the Commonwealth should resolve several of the mixed waste management difficulties:

(1) The annual survey of radioactive materials users, conducted pursuant to Chapter 111H, section 7, will be used as an information-gathering tool on mixed waste generation, treatment, and storage, and also as a vehicle to test radioactive materials users' knowledge and awareness of mixed waste treatment potential.

(2) The Management Board and DPH should cooperate in holding meetings, workshops, and other informational sessions with radioactive materials licensees and professional societies, to help educate them about mixed waste storage, treatment, and disposal issues. Information on mixed waste treatment technologies and practices, as well as the locations of new mixed waste treatment facilities nationwide, should be routinely disseminated to radioactive materials licensees.

(3) DPH, responsible for establishing a program to minimize and eliminate, where possible, radioactive sources and LLRW, should include provisions in its regulations to require:

- substitutions of materials and processes which, to the greatest extent possible, are economical, protective of the public health and the environment, and retain the quality of the material or product of interest, which will eliminate or reduce mixed waste; and

- all treatment practices which, to the greatest extent possible, are protective of the public health and the environment, are economical, and retain the quality of the material of interest, which will eliminate the radioactive component of mixed waste.

(4) DEP should modify its "applicability" provision in 310 Code of Massachusetts Regulations (CMR) 30.500, which currently prohibits the use of the treatment method known as "storage for decay"[2] for mixed waste containing short half-life material. With a change in that regulation for short half-life mixed waste, the radioactive contaminants of the waste could decay to natural background levels with essentially no radioactivity remaining, and thereby change the mixed waste into "hazardous waste," for which there is treatment and disposal available.

In addition to modifying the DEP regulation described above, once Massachusetts becomes an Agreement State, DPH and DEP should establish an inter-agency task force to identify duplicative and inconsistent regulations, and develop procedures for their reduction or eradication, within the bounds allowed by EPA and NRC. The task force should concentrate its initial efforts on modifying 310 CMR 30.500.[3]

(5) The Management Board will continue to explore all realistic alternatives for the disposal of mixed waste. Such alternatives will continue to include negotiations with the U.S. Department of Energy (DOE) for the establishment of a mixed waste disposal facility at an existing DOE research site that would be available to both federal and commercial mixed waste generators. The Board will also negotiate with other states who plan to accept mixed waste at their disposal facilities.

Management Plan Recommendation #7: LLRW Transportation Enhancements

LLRW transportation will occur in Massachusetts regardless of disposal facility availability or in-state siting, since generators will continue to transport waste to processing companies for treatment. Because Massachusetts officially assumed responsibility for LLRW management on Jan. 1, 1993, the impacts on the public and the LLRW-generating community of radioactive shipments must be continuously evaluated.

The Management Board recommends that LLRW shipments be made only if they have the highest possible prospect of arriving at their destinations safely, in a manner acceptable to the destination entity, without environmental damage and without exposing the Commonwealth to contingent liabilities. LLRW should be considered to be available for shipment only when:

(1) Prior agreement has been reached with a destination entity licensed to receive the LLRW;

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[2] "Storage for decay" is a procedure in which LLRW with relatively short half-lives is held for natural radioactivity decay in compliance with applicable federal and state regulations, thereby allowing the waste to be disposed of as essentially non-radioactive trash.

[3] A similar effort is underway at the national level, to press NRC and EPA for clarity and consistency in its mixed waste regulations. Massachusetts officials are involved in that effort.

(2) All terms of the agreement, including any waste acceptance criteria or requirements for payment of a fee, have been complied with;

(3) All regulatory requirements governing the packaging or shipment of LLRW have been complied with; and

(4) All measures appropriate to the LLRW shipment have been taken to ensure that the waste can be received safely at its destination.

In 1991, the Management Board adopted the four principles listed above, as a "re-entry" policy. This policy recognizes the importance of protecting the Commonwealth from the same issues that concern LLRW processors: title and liability for abandoned waste. While the policy is designed to encourage the use of out-of-state treatment, it also makes clear the State's present obligations concerning possession, storage, and disposal.

For the transportation of high activity LLRW in "highway route-controlled quantity" shipments, The Board recommends that back-up drivers be available to eliminate any need to stop at night, so that shipments can proceed expeditiously and at times of lower traffic densities.

Management Plan Recommendation #8: Transport Notification

The Commonwealth should work to establish a cooperative arrangement with Connecticut and any other state whose LLRW transportation requirements prevent certain shipments of LLRW, spent nuclear fuel, and high-level radioactive waste resulting from the decommissioning of such sites as Yankee Rowe (and later, Pilgrim Station in Plymouth) from moving through their states at night when highways are least populated. This rule could force shippers of highly radioactive wastes to stop overnight on the Massachusetts border, or instead to drive longer, out-of-the-way routes in order to proceed on their journeys.

Management Plan Recommendation #9: Decommissioning Activities

Since the decommissioning of radioactive materials user facilities may occur during the period of limited or no disposal facility availability to Massachusetts generators, some of the decommissioning LLRW may have to be stored temporarily on site. Although regulatory constraints and proper precautions limit potential incidents and consequences, storage of large quantities of LLRW carries with it potential risks to workers and the public. The Commonwealth should receive continued assurances, from the certified responses to the Management Board's annual survey, as well as through routine site visits, that all waste in storage is being managed properly.

Because nuclear power plant decommissioning is the regulatory responsibility of the NRC, not State government, the chief regulatory interplay will occur between the nuclear utility companies and the federal government, not the State. The Commonwealth, through the DPH, should execute an agreement with each of the two nuclear utility companies to allow state personnel access to any interim storage facilities developed for decommissioning waste.

In addition, with regard to the decommissioning of Yankee Rowe and Pilgrim Station, DPH, the Massachusetts Emergency Management Agency (MEMA), and the Management Board should coordinate their efforts to monitor the development of decommissioning plans and work with the NRC to confirm that decommissioning techniques are planned and implemented to keep radiation exposures as low as reasonably achievable.

Revisions in NRC decommissioning regulations, adopted in 1988, eliminated the requirement for an

environmental Impact statement as part of a nuclear power plant decommissioning plan submitted to the NRC for review and approval. Instead, the NRC will consider the need for an environmental impact statement on a facility-by-facility basis. Because actions relating to power plant decommissioning are of considerable concern to many of the citizens living around a power plant such as Yankee Rowe, and due to the current status of planned disposal site closure (at Barnwell, South Carolina) after June, 1994, the Commonwealth should consider whether an environmental impact study is necessary, and communicate its recommendation to the NRC prior to a determination by that agency.

In considering centralized storage or disposal facilities for the Commonwealth's LLRW generators, Massachusetts should evaluate the types of radionuclides contained in decommissioning waste, and consider requirements for segregating, monitoring, and retrieving long-lived wastes.

Management Plan Recommendation #10: Improving the Safety or Efficiency of Storage Technologies and Practices

The following recommendations are based upon the Management Board's evaluation of the potential health, safety, and environmental impacts of storage; its climatic, geologic, hydrogeologic and other requirements; its suitability for LLRW managed in Massachusetts, and its cost-effectiveness.

(1) Storage for decay should be encouraged to the fullest extent of each radioactive materials licensee's ability, consistent with the licensee's materials and processes, and within the constraints of the license.

(2) All LLRW requiring interim or long-term storage should be packaged in ways that protect the public health and the environment. In planning for storage, the Management Board encourages generators to be cognizant that packaging, treatment, and disposal standards could possibly change during a storage period, thereby requiring LLRW to be repackaged for ultimate disposal.

(3) Long-term storage (more than five years) should be encouraged only if: (a) all treatable waste has been processed for reasonable stability, and (b) all treatable waste has been processed to reduce volumes of waste ultimately requiring disposal.

(4) The Commonwealth should provide an adequate number of qualified personnel in the DPH Radiation Control Program to ensure its capability to perform necessary inspection and enforcement activities relating to on-site storage.

(5) The Management Board encourages the DPH, once it assumes Agreement State regulatory authority, to develop procedures requiring LLRW generators who will store waste on site (if and when access is lost to the Barnwell, South Carolina, disposal facility) to notify and educate municipal officials about the uses of radioactive materials, and the types, forms, and characteristics of waste in storage that may require local emergency response actions.

(6) The Commonwealth should provide technical assistance to LLRW generators on storage problems.

(7) Because the two nuclear power plants in Massachusetts will continue to be regulated by the NRC (even after the Commonwealth becomes an Agreement State), DPH and the utilities should develop an arrangement that interim or long-term storage at the nuclear power plant sites will be consistent with DPH storage requirements.

Management Plan Recommendation #11: On-Site Storage Technical Assistance Program

If and when access is lost to the Barnwell, South Carolina, disposal facility, as is expected by June 30, 1994, the Commonwealth should provide technical assistance to all LLRW generators to ensure that they are prepared to store their LLRW on site for the maximum period of time allowed by federal and state regulation (currently five years).

Recommendations to Enhance Various Facility Siting Performance Plans

Management Plan Recommendation #12: Notification

If the Management Board votes to initiate the siting of a centralized storage or disposal facility, the Board is required by Chapter 111H to notify the Chief Executive Officer (CEO) of every municipality in the Commonwealth that the siting process has commenced. In addition to that notification, the Management Board will notify the Chief Elected Officer of every municipality. The Board will be guided by a policy to inform communities and their elected and appointed leaders as soon as possible about decisions that may affect their localities.

The Board will send press releases to pertinent newspapers, radio and television stations, and will include an explanation of the public's role in LLRW management. The Board's Public Participation Coordinator and other Board staff will be available to attend meetings, conduct workshops, brief federal and state legislators and local officials, and generally to speak to interested groups about the siting process, to provide information, to answer questions and listen to concerns of the public.

In addition, the Management Board will notify other states interested in negotiating the possibility of their LLRW generators gaining access to a Massachusetts site. Discussions with other states will include such topics as the percentage of facility siting costs that each state would be willing to fund, and the terms and conditions of a regional compact or contractual agreement.

Management Plan Recommendation #13: Choosing Facility Size

As a result of those interstate discussions, and with the consideration of public comments made during the statewide public meetings prior to adoption of this LLRW Management Plan, the Management Board will select one of the four facility sizes listed in the Disposal Facility Siting Performance Plan, and will determine the size and duration of any centralized storage facility.

Management Plan Recommendation #14: Voluntary Siting Stage

As part of the notification to municipal officials and others of a decision to site a centralized storage or disposal facility, the Management Board will inform community leaders of the "volunteer" siting stage of the process, and will encourage them to participate. The Board will then initiate a series of public meetings, over a period lasting about six months, to develop the details of its volunteer program.

After the Board has completed its first statewide screening to eliminate potentially unsuitable areas of the Commonwealth, and has issued its Statewide Mapping and Screening Report, all municipalities with possible locations still under consideration will receive a second notice of the voluntary siting program, as well as information about compensation and impact payments, and will be encouraged to participate. Any "volunteered" sites will continue to be evaluated as long as they meet the site criteria for candidate sites. Any "volunteered" sites that fail the environmental screening process will be eliminated from consideration.

Management Plan Recommendation #15: Grants to Evaluate Siting Effects

In the notification to every city and town that the siting process has been initiated for a "non-emergency" centralized storage facility or a disposal facility, the Management Board will inform municipalities and others that grant funds will be available to those who may be interested in possibly volunteering a site, after the issuance of the Statewide Mapping and Screening Report. Grants will be provided by the Management Board to enable communities to evaluate the potential economic impacts of having an LLRW disposal facility within their borders.

At the same time, municipalities and others will be informed that the siting process will evaluate the entire state, in order to identify the most suitable "candidate sites" for further evaluation.

Management Plan Recommendation #16: Siting Plan

With assistance from the Public Participation Coordinator, when centralized storage or disposal facility siting is initiated, the Management Board will prepare a "siting plan" identifying the major decision points in the State's siting process, and summarizing the roles of responsible state agencies and potential site communities. The plan will be made available to all interested parties.

Management Plan Recommendation #17: Regional Financing

If a decision is made to site a regional disposal facility, all or the greater portion of the costs of the siting process will come from the non-host states selected to utilize a disposal site in the Commonwealth. If a decision is made to site a centralized, regional storage facility, revenues to augment the costs of facility operation, closure, post-closure, and institutional control, will come from contracts with other states.

Management Plan Recommendation #18: Public Review of the Mapping and Screening Report

Chapter 111H requires the Statewide Mapping and Screening Report to be "issued" to the public. The law does not, however, require that such issuance involve public hearings, or public review and comment. Such a review will enhance the participation of the public in siting activities.

Management Plan Recommendation #19: Additional Public Notification

If the Management Board votes to proceed with detailed site characterization, the Board will send copies of the Candidate Sites Identification Report to all municipal libraries of impacted communities.

Management Plan Recommendation #20: Facility-Related Transportation Actions

The potential impacts of transporting LLRW to an in-state centralized storage or disposal facility would be evaluated throughout the siting process, both through the use of DEP's facility siting criteria which must be observed by the Management Board and its consultants, and through MEPA reviews built into the siting process. In addition to these evaluations of transportation impacts, the following are recommended:

(1) MEMA, the State Police, DPH, and other appropriate state agencies should plan, train for, and execute LLRW shipment emergency response exercises. Such exercises will improve the technical quality of emergency response procedures, and increase public confidence in the response system.

(2) While candidate sites are undergoing detailed site characterization, the Management Board will

develop estimates of the number of LLRW shipments necessary to travel to each potential site during a given timeframe, and will plan traffic controls to minimize any potential traffic problems. The development of these plans will utilize, to the extent possible, the transportation planning efforts of state, regional, and local planning agencies, in connection with the transportation planning requirements of the federal Intermodal Surface Transportation Efficiency Act of 1991.

Management Plan Recommendation #21: Disposal Facility Insurance

The Commonwealth will require strict requirements for financial mechanisms to ensure defense and payment of third-party claims as well as the clean-up of a contaminated site, if contamination were to occur. The Management Board will require a disposal facility operator to purchase the following insurance plans:

(1) All-Risk Property insurance to insure the facility itself (including costs of replacing buildings and equipment) in an amount equal to the facility's replacement costs, or the maximum amount available, whichever is less;

(2) Comprehensive General Liability insurance with minimum limits of $25 million dollars per occurrence and $25 million in the aggregate;

(3) Environmental Impairment Liability insurance with minimum limits of $10 million, or such greater amounts, up to the maximum loss potential determined by a risk assessment acceptable to the Management Board, as may from time to time be commercially available; and

(4) Nuclear Energy Liability Insurance, with minimum limits equal to $25 million or the maximum loss potential determined by a risk assessment acceptable to the Management Board. The Board will require the facility operator to agree to use its reasonable best efforts to obtain such insurance at the required amount. Since such insurance is not currently available in amounts over $25 million, the operator will alternatively be required, through a letter of credit or other acceptable means, to establish an escrow arrangement equal to the difference between the available nuclear energy liability insurance policy limits and the required insurance amount.

Management Plan Recommendation #22: Improving the Safety or Efficiency of Disposal Technologies and Practices

The type of disposal technology (i.e., above-ground vaults, below-ground vaults, above-ground canisters inside vaults, etc.) for any LLRW disposal facility sited, developed, operated, and closed in accordance with Chapter 111H, must be selected by the site community, not the Commonwealth. Regardless of the disposal method chosen, the Management Board has a number of recommendations to improve the safety or efficiency of such a facility. They are:

(1) The Management Board will provide technical assistance to potential disposal facility site communities in order to help them evaluate LLRW disposal technologies and practices, and their suitability at each candidate site location.

(2) Chapter 111H requires that conditions under which waste would be accepted into a Massachusetts disposal facility must be reviewed by the Management Board yearly. As part of such review, the Board will continuously evaluate such factors as waste form, stability, and pre-treatment requirements, in order to enhance the facility's ability to (a) safely dispose of LLRW, (b) keep radiation exposures as low as reasonably achievable, and (c) operate in a

manner most protective of the public health, safety, and the environment.

(3) The Management Board will evaluate the implications of approving waste acceptance criteria that could result in concentrating the amount of activity in the waste, and thereby moving some LLRW out of Class A, B, or C, and into the Greater Than Class C (GTCC) Waste category. While GTCC waste is the responsibility of the federal government, not the states, no GTCC disposal site is available to accept the waste that might result from certain waste acceptance criteria.

(4) Waste will be segregated in a disposal facility by short and long radioactive half-life in order to enhance the safety and efficiency of any retrieval activity that may later be required.

(5) Appropriate monitoring systems will be installed to monitor both below and adjacent to each disposal unit, in order to immediately detect any radionuclide movement.

(6) Because disposal of Class C waste poses the greatest potential long-term radiological threat, consideration will be given to requiring additional barriers, including packaging, for Class C waste disposal, besides those provided by the disposal facility technology.

(7) Remedial action plans, containing basic policies for remediating general categories of potential contamination incidents, will be prepared and approved as part of the comprehensive operating contract, prior to operation, in the unlikely event of a contamination incident.

(8) A plan for disposing of water, soil, and other materials collected during monitoring and sampling will be prepared and submitted for approval prior to operation. It may be appropriate for such plan to be incorporated into the comprehensive operating contract.

(9) The comprehensive operating contract will include provisions for: (a) employing methods during facility operation to force water to drain away from disposal units; and (b) not placing waste packages into disposal units during adverse weather conditions, unless methods are followed to prevent rainwater entry into the units.

(10) The Management Board will evaluate carefully all disposal fees in order to ensure that the contingent liability and institutional control accounts within the Low-Level Radioactive Waste Trust Fund will contain enough funds to (a) properly maintain the facility throughout the institutional control period, (b) provide for compensation for injuries to persons, land or property; and (c) provide sufficient funds for decommissioning in the event a site is closed prematurely.

Management Plan Recommendation #23: Property Value Protection

Chapter 111H includes explicit provisions for compensation and impact payments to site, affected, and neighboring communities, and negotiations with these municipalities: The subjects for negotiation are not precisely defined in the law, in order for the communities impacted by facility siting to have the flexibility to negotiate conditions which best serve their needs. A summary of the compensation and impact payments potential is included in Chapter 6, section 6.24, of this volume. Additional details can be found in Chapter 16 of VOLUME II.

The Management Board recommends that a facility operator-funded property value guarantee program be instituted, which provides: (1) a pledge of property value protection for properties surrounding each candidate site that will undergo detailed site characterization, and (2) a specific property value guarantee for properties surrounding whichever candidate site is chosen as the superior site once the facility

receives a license. This property value pledge and guarantee system includes the following provisions:

(1) As of the date the Management Board votes to accept the Candidate Sites Identification Report, which names candidate sites that the Board believes should undergo detailed site characterization, property owners within a half-mile radius of any waste management area identified within each candidate site will receive a pledge notice from the Board explaining that, if the site were chosen and licensed for the development of a facility, their property will automatically be included within a "Property Value Protection District" surrounding the candidate site. In addition, property owners outside the one-half mile radius but within one mile of any waste management area identified within each candidate site will be eligible to have their property considered for inclusion within the Property Value Protection District, by determination of the Management Board, with the advice of the Community Supervisory Committee of each candidate site.

(2) Any property within the Property Value Protection District will have the benefit of a pledge of property value protection, which will operate throughout detailed site characterization. This pledge will help to stabilize property values during this period by assuring property owners that the value of their property will be guaranteed if the site is ultimately selected and a facility is licensed.

(3) Once a superior site has been licensed, the owner of any property identified within the Property Value Protection District of the superior site will be entitled to receive a payment from the facility operator, equal to the lost value that the property would have had, but for the location of the facility. The guarantee will cover all properties within the superior site's Property Value Protection District which are sold after the adoption of a Candidate Sites Identification Report, and will extend until five years after the facility is licensed.

(4) A seller seeking compensation for lost value of real property must submit a request for compensation to the Board, and include in his request a number of documents:

- a copy of a purchase and sale agreement executed after the date of the Board's adoption of the Candidate Sites Identification Report;
- a copy of the deed conveying title, as well as other documentation that the deed has been recorded at the Registry of Deeds;
- an appraisal by a qualified person, of the actual value of the property as of the date of execution of the purchase and sale agreement; and
- an appraisal by a qualified person, of the value the property would have, but for the facility or the possibility of the facility being sited in that location.

(5) The facility operator will pay the seller an amount equal to the difference in the value such property would have, as of the execution of the purchase and sale agreement submitted to the Board, but for the facility's location or the possibility of a facility, and the actual value of the property as of the date of execution of the purchase and sale agreement. The amount to be paid the seller will be determined by the Management Board, after it receives comments from the facility operator.

(6) Only record owners of properties at the time of the adoption by the Management Board of the Candidate Sites Identification Report will be eligible to receive property value pledges and guarantees, not persons acquiring any of the affected properties after that time.

(7) Property owners within the Property Value Protection District will be guaranteed no loss in property value in return for granting the facility operator or the State the right of first refusal for any valid offer received on the property.

In addition, the pledge and the guarantee will provide relief only from specifically local adverse market conditions, as such market conditions differ from regional or national conditions. For example, the guarantee should not provide relief from natural disasters or acts of God, or from depreciation due to the failure of real estate owners to maintain their property.

This operator-funded property value guarantee system will be delineated in the "comprehensive operating contract" – a legally-binding document signed by the facility operator and the State.

Enhancing Treatment Facility Siting

Management Plan Recommendation #24: Treatment Facility Considerations

As noted in the determination of need discussion in Chapter 3 of this volume (and in Chapter 15 of Volume II), no need exists at this time to site a centralized treatment facility within the Commonwealth, because of the availability of both on-site and off-site commercial treatment operations. However, if at some future date, the Commonwealth were to ascertain that a need exists for an in-state treatment facility, the Management Board and the site community should consider the selection of incineration treatment technology only after making a determination that out-of-state incinerators will no longer be available to process LLRW generated in Massachusetts in an economical and environmentally-acceptable manner.

Enhancing Centralized Storage and Treatment Facility Siting

Management Plan Recommendation #25: Adequacy of Insurance for Treatment and Storage Facilities

Because this Management Plan includes a finding that no need exists to develop treatment capacity within Massachusetts through the next decade, and no need exists for storage capacity until the latter part of the decade, the Management Board will require that any decision to site treatment or storage facilities pursuant to Chapter 111H be followed by a financial risk assessment. The same types of insurance recommended for a disposal facility will be required for storage and treatment facilities, but maximum limits will be determined with a consideration of the specific storage and treatment activities anticipated.

Chapter 6: Summary of Issues Affecting LLRW Management

6.1 Introduction

Low-level radioactive waste (LLRW) management involves a complex set of issues. They range from the mandates of federal law which has assigned states the responsibility for LLRW management, to the importance of public participation in making LLRW policy decisions.

Many of the issues discussed are explicitly required by Massachusetts General Laws c.111H (Chapter 111H), the State's Low-Level Radioactive Waste Management Act. For example, this law requires that the LLRW Management Plan include a Massachusetts LLRW "classification system" for all LLRW generated, treated, or disposed of within the Commonwealth. Such a system must provide the means for the state to categorize LLRW on both its radiological toxicity and radioactive half-life,[1] as well as its chemical and biological toxicity and form.

A summary of the subjects required for inclusion in the Management Plan appears on Page 1-2 of VOLUME II; Chapter 111H appears in its entirety in Appendix A at the end of VOLUME II.

Numerous LLRW management issues that were evaluated by the Low-Level Radioactive Waste Management Board, and led to various policy decisions, are summarized in this chapter. Recommendations stemming from these policies are listed in Chapter 5 of this volume. The location of additional information on each subject appears in brackets ([]) to denote the chapters in VOLUME II where this material can be found.

6.2 Radiation Sources

[VOLUME II, Chapter 3]

All matter is composed of different types of atoms, called isotopes. An isotope is radioactive if it changes from one atomic form to another through a spontaneous disintegration, known as "decay" of the nucleus. When some atoms decay, they produce radiation, and are called "radionuclides" or "nuclides." The rate of the decay process differs with each radionuclide, and is measured in terms of the "half-life." With the completion of the decay process -- which may last from fractions of seconds to billions of years -- the atoms eventually become non-radioactive.

There are a number of units used to describe the amount or quantity of a radionuclide, and the exposure or "dose" which measures the amount of energy emitted in the form of radiation absorbed by

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[1] "Half-life" is the time in which half the atoms of a particular radioactive substance disintegrate to another nuclear form.

people, animals, or other matter. Units describing the quantity of radioactivity include:

- **Activity** -- the rate of decay of radioactive material.
- **Curie** Ci) -- a unit of activity which represents the quantity of any radionuclide that undergoes 37 billion disintegrations per second (3.7×10^{10} d/s).
- **Microcurie** (uCi) -- one millionth of a curie (3.7×10^{4} d/s).
- **Becquerel** (Bq) -- the international unit of activity, is analogous to the curie (1 becquerel = 1 decay per second = 2.7×10^{-11} Ci).

Units describing radiation dose and exposure include:

- **Absorbed dose** -- the amount of energy imparted by ionizing radiation per unit mass of irradiated material.
- **Dose equivalent** -- the product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest.
- **Effective dose equivalent** -- the sum of the products of the dose equivalent to the organ or tissue, and the weighting factors applicable to each of the body organs or tissues that are irradiated.
- **Total effective dose equivalent** -- the sum of the dose at a tissue depth of one centimeter for external exposures plus the dose equivalent to organs or tissues that will be received from an internal exposure to radioactive material during the 50 years following the intake.
- **Rad** -- a measure of a specified amount of radiation energy per gram of material, such as living tissue. In the case of x-rays, gamma rays, and some beta particles, the rad equals the rem.
- **Rem** -- the unit of measurement of any of the quantities of "dose equivalent." The dose equivalent in rems is equal to the absorbed dose in rads multiplied by a "quality factor" to account for biological reactions to radiation based upon the type of radiation and other factors.
- **Millirem** (mrem) -- the measure of exposure of low radiation levels, equal to one thousandth of a rem.
- **Sievert** (SV) -- the international unit of dose equivalent (1 sievert = 100 rem).
- **Person-rem** -- measures the total radiation dose received by a whole population (= number of people In population group X the average radiation dose In rem).

Lifestyle, geographical location, career, and other factors affect the total annual radiation exposure received by humans. Using the millirem as a common measurement, radiation received from natural sources (such as cosmic radiation; internal exposure from natural radioactivity In food, water and air; and radon[2] exposure) is about 330 millirem per year. We receive an additional 30 millirem from man-made

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[2] "Radon" is a naturally occurring radioactive gas that is released from soils. Homes and other structures can collect and concentrate radon Indoors. Indoor radon Is the largest single source of radioactivity to which the public is exposed, averaging about 200 millirem per year.

radiation (medical x-rays, nuclear medicine, consumer products, nuclear power production, etc.), for an average yearly whole body dose[3] of 360 millirem.

Figure 6-A shows an example of possible doses from common sources of natural and man-made radiation.

Figure 6-A
Calculating an Individual's Annual Radiation Exposure
Possible Doses from Common Radiation Sources[a]

Location, Career and Lifestyle Affect Annual Radiation Exposure	Millirem
Where a person lives	
Natural background radiation from external sources - Boston	65
Home construction materials (stone, concrete, masonry)	7
Radon (U.S. average)	200
What one breathes, eats, and drinks	
Food, water, air (U.S. average)	24
Fallout from world-wide weapons testing	1
Living Habits	
Chest x-ray[b]	20
Airplane travel[c]	2
Watching television 4 hours/day (at .15 mrem/hour)	0.6
Using computer with video display terminal	<1
Sleeping with partner, add 0.1 mrem	0.1
Cooking with natural gas, add 6 mrem	6
Smoke detectors (type made with Americium - 241)	0.6
Total annual dose for this example	327.3
U.S. annual average dose	360

[a] Doses are estimates only, and vary at any given time.
[b] The U.S. average annual dose from medical and dental x-rays and other medical treatment is 50 millirem. One chest x-ray is 20 millirem.
[c] Assumes one-way coast-to-coast flight, at 36,000 feet.

Sources: U.S. Environmental Protection Agency and U.S. Department of Energy.

"Ionizing" radiation -- one group of the broader category of "radiation," is the type of radiation associated with radioactive materials and radioactive waste, and consists of energized particles or waves of energy that cannot be detected by the senses, but can electrically charge stable atoms, sometimes causing them to change their chemical structure. If this process occurs to living tissue, there may be no adverse health impacts, or minimal to serious health effects may result.

The three principal forms of radiation from radioactive materials and waste -- "alpha," "beta," and

[3] "Whole body dose" is to be interpreted to mean "effective dose equivalent" wherever it appears in this Management Plan. The former term is used in many regulations and documents cited herein, and is retained in the Plan for consistency with the referenced documents. The latter term represents recent changes in expressing dose.

"gamma" – may cause different effects from their exposure, because they have differing energy levels.

6.3 Radiation Protection Standards

[VOLUME II, Chapter 3]

The U.S. Nuclear Regulatory Commission (NRC) sets maximum limits for individuals working around radioactive materials (occupational dose) which vary depending upon the part of the body, or the whole body, receiving the radiation dose. In general, the permissible occupational whole body dose is no greater than 5 rem (5,000 millirem) per year for adults, and 10% of that level for children and pregnant women.

The maximum dose to the public may not exceed 0.1 rem (100 millirem) yearly for the total effective dose equivalent as well as no more than 0.002 rem (2 millirem) in any one hour in any unrestricted area, where no radioactive materials are licensed for use. The NRC may allow up to 0.5 rem (500 millirem) in a year to an individual by specific petition of the radioactive materials licensee, such as for cancer patients who must receive radiation treatments. However, these patients receive large doses to small areas or specific organs, not a whole body dose.

Additional limits on radioactivity are set by the NRC in connection with LLRW disposal facilities, and by the U.S. Environmental Protection Agency (EPA) in its drinking water and air quality standards. The NRC's LLRW disposal facility regulations prohibit any release of radioactive materials into groundwater, air, soil, plants, or animals that would result in an annual dose to a member of the public greater than 25 millirem to the whole body, 75 millirem to the thyroid, and 25 millirem to any other organ. Similarly, EPA regulations limit doses to the public from all sources in the uranium fuel cycle (such as spent fuel storage and disposal, and power reactors) to 25 millirem per year.

6.4 Health Effects of Radiation Exposure

[VOLUME II, Chapter 3]

Depending upon the amount and duration of the absorbed dose, the type of radiation, the distribution of the dose (i.e., to the whole body or only a specific organ), and the age of the exposed individual, damage to living tissue can range from ~~none~~, to ~~radiation sickness~~, to ~~genetic effects~~, to ~~death~~. For these reasons, limits are placed on radiation exposure. Packaging, storage, transportation, and disposal standards have been established to ensure that the public is exposed to little or no radiation from various uses of radioactive materials.

The damage that extremely large doses of radiation can cause to living cells is well documented, and on-going studies monitor the health effects from such large doses as those received by the residents of Hiroshima and Nagasaki, Japan, during World War II.[4] However, while even small doses of radiation are known to damage living cells, the ultimate health impact of that damage is not as well understood, or universally agreed upon. The degree and effect of possible damage may be influenced by such factors as body size, age, varying sensitivities of body tissues and organs, long latency periods, and the impact of

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[4] It is estimated that Hiroshima and Nagasaki bombing victims were exposed to between 1 and 200 rads, with the average exposure less than 20 rads (20,000 millirads), according to the "BEIR V" Committee of the National Research Council/National Academy of Sciences' publication, Health Effects of Exposure to Low Levels of Ionizing Radiation, Washington, DC, 1990.

natural radiation exposure. Also, environmental factors, such as diet, smoking, or exposure to hazardous chemicals, can cause similar biological effects, making it difficult to establish specific cause-and-effect relationships.

The debate over the health effects of radiation will continue, and differing scientific and non-scientific viewpoints will be expressed. In the meantime, however, Massachusetts uses standards set by federal and international radiation protection agencies in protecting the public from radiation exposure. These standards are considered by most scientists to ensure public health protection by keeping radiation doses as low as reasonably achievable, a standard known as "ALARA."

After careful consideration, the Low-Level Radioactive Waste Management Board has arrived at the conclusion that the apparent risks to workers and the public at the levels of exposure currently allowed by regulation are sufficiently low to allow the Board to proceed with its LLRW management programs. The Board views the current regulatory scheme for LLRW management, facility development, and radiation protection of the public as adequate, based on current knowledge, and acknowledgement of scientific uncertainty regarding the health effects of ionizing radiation at very low dose and dose rates (1-25 millirem per year), such that facility siting could proceed, if the Board votes to do so.

The Board also believes that the requirements of Chapter 111H and Massachusetts General Laws c.111 (state radiation protection requirements), and the regulations of the Management Board, the Department of Public Health (DPH), and the Department of Environmental Protection (DEP) supplement federal regulations to ensure additional protection of the public health. The Board will actively monitor radiation health studies, and related science and technology, and will revise development plans and standards as required to reflect the latest information.

6.5 History of LLRW Management

[VOLUME II, Chapter 1]

LLRW disposal activities in the United States were initiated in the 1940s with the establishment of 14 shallow land burial sites on federal government properties for the disposal of LLRW produced from federal nuclear weapons research and development programs. Ocean dumping was later authorized by the federal government, but was subsequently banned in 1970. Both federal government and non-federal government (commercial) LLRW generators used the ocean disposal and federal landfill sites; the federal shallow land burial locations ceased to be available to commercial generators in 1960 when the U.S. Atomic Energy Commission (AEC) closed those sites to the commercial sector.

As a result, six commercial LLRW disposal sites were established in Beatty, Nevada; Barnwell, South Carolina; Hanford, Washington; Maxey Flats, Kentucky; Sheffield, Illinois; and West Valley, New York. A seventh site opened in the late 1980s to dispose of Naturally-Occurring Radioactive Materials (NORM) and some limited types of LLRW. An appendix to Chapter 1 of VOLUME II describes all seven sites, as well as the operational problems at some of them. Features of the six major LLRW disposal sites are highlighted in Table 6-1.

6.6 LLRW Management Laws

[VOLUME II, Chapters 1, 2, and Appendices A, C, and D]

The federal Low-Level Radioactive Waste Policy Act of 1980 assigns to each of the 50 states the

responsibility for LLRW disposal, either inside or outside a state's borders. It also encourages states to establish regional agreements, called "compacts," to site and operate regional disposal facilities. An incentive to regionalize is a provision in the law that allows regional compacts to **exclude** waste from outside their regions.

Amendments to the 1980 federal law, known as the Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLRWPAA), strengthen the requirements for state action to assume disposal responsibility. This Act includes mandatory deadlines, incentives, and penalties to force unsited states and regions to build new facilities. The most significant of all the deadlines is Jan. 1, 1993, the federally-mandated deadline by which states were to assume responsibility for LLRW management, and also the date when the states that had hosted three sites in South Carolina, Nevada, and Washington could cease accepting waste from out-of-region generators.

The LLRWPAA also included another deadline which was subsequently declared unconstitutional by the U.S. Supreme Court in June, 1992. [New York v. United States] That deadline would have required any state that did not have a disposal arrangement by Jan. 1, 1996, to take title to the waste generated within its borders, and to be liable for failing to take possession of that LLRW. Massachusetts and other states joined New York in challenging this provision, which would have had serious, financial implications to each state.[5]

The lead federal agency for LLRW management is the U.S. Department of Energy (DOE); the chief regulatory agency responsible to set radiation protection standards, and to license radioactive materials users[6] and LLRW disposal facilities is the NRC. The other federal regulator, the EPA, has set radiation standards limiting public exposure from air emissions and drinking water supplies, and, in concert with the NRC, controls the small portion of LLRW that contains, or exhibits the characteristics of, hazardous chemicals (called "mixed" waste). EPA is also planning to issue regulations on radiation standards for LLRW storage, treatment, and disposal. It is not known when such standards, which have been in the preliminary development stage for several years, will be issued for public review and comment.

State LLRW Management Laws

To provide a system for managing the storage, treatment, and disposal of LLRW, the Massachusetts Legislature adopted the Low-Level Radioactive Waste Management Act, Massachusetts General Laws c.111H, in December, 1987. In addition, the Commonwealth worked for several years through a regional group of states, called the Coalition of Northeastern Governors (CONEG), in pursuit of a regional disposal solution. Due to an inability of the "large-volume" LLRW generating states and the "small-volume" generating states to agree on a mechanism for selecting a regional disposal facility "host state," the CONEG coalition of 11 states ultimately split into three regional compacts (Northeast, Texas, and Appalachian) and a group of states not affiliated with a compact (referred to as "unaffiliated" states). Massachusetts, New Hampshire,

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[5] The Management Board recommended that Massachusetts Attorney General Scott Harshbarger join Ohio and other states' Attorneys General in challenging the "take title" provision of federal law. Attorney General Harshbarger agreed to pursue this matter, with assistance from the Management Board's counsel.

[6] There are 23,000 licensed users of radioactive materials in the United States. Approximately 8,000 of them are licensed by the NRC; the rest are licensed by the comparable state regulatory agencies under the Agreement State program. All nuclear-powered reactors and federal entities that use radioactive materials are licensed by the NRC, no matter whether they are in an Agreement State or not. [See discussion of Agreement State authority in VOLUME II, Chapter 2.]

Table 6-1
Features of Six Major Commercial LLRW Disposal Sites

Site	Site Opened	Site Closed	Site Size (acres)	Depth to Ground-water (feet)	Average Yearly Rainfall (inches)	Number of Disposal Trenches	Trench Depth (feet)	Trench Length (feet)	Trench Width (feet)	Trench Cover	Site Problems Leading to Closure
Beatty, Nevada	1962	Dec. 31, 1992	80	260-330	2.5-5	22	6-50	300-800	4-350	Earth	Site is closing by the state's choice, not because of any "problems."
Maxey Flats, Kentucky	1963	1977	280	30-50	46	52	9-30	150-680	10-75	Earth	Rain water accumulating in trench-es, causing activity to migrate out of the trenches.
West Valley, New York	1963	1975	22 [a]	– [b]	39	14	20	600	30	Earth	Radioactively contaminated water accumulation in trenches, and seeping through earth cover.
Hanford, Washington	1965	– [c]	100 [d]	200-360	6.3	14	20-45	300-840	25-140	Earth	None. See footnote c.
Sheffield, Illinois	1968	1978	190	15-65	35	21	20-25	500	50-60	Earth	Groundwater migration of activity.
Barnwell, South Carolina	1971 [e]	– [f]	300	30-60	29-73	Standard A: 4 Standard B: 69 Slit: [g] 12	A: 15 B: 21 Slit: 22	A: 200 B: 1,000 Slit: 500	A: 50 B: 100 Slit: 4	Earth	See footnote f.

[a] The 22-acre West Valley LLRW disposal site was part of a 3,345 acre site that included such operations as a commercial nuclear reprocessing plant, a storage facility for liquid high-level radioactive waste, and spent fuel storage and landfill disposal facilities.
[b] The West Valley site is approximately 450 feet above sea level. Depth to groundwater has never been scientifically determined, because the problem of contaminants in water at the site does not relate to groundwater. Instead, it is a problem related to rain water runoff. Radioactively-contaminated rain water has overflowed from the trenches (i.e., the "bathtub" effect), and has run off the slope of the site into a nearby stream.
[c] The Hanford, Washington, LLRW disposal site will continue to operate as the regional disposal site for the Northwest Interstate Compact (Alaska, Hawaii, Idaho, Montana, Oregon, Washington, Wyoming, and Utah), and has contracted to accept waste from the Rocky Mountain Compact states (Colorado, Nevada, and New Mexico).
[d] The 100-acre Hanford disposal site is part of a 3,000 acre tract owned by the U.S. Department of Energy.
[e] The Barnwell site opened in 1969 as an above-ground LLRW storage facility, but was later licensed (1971) as a disposal site, using shallow land burial.
[f] The Barnwell site will remain open to generators within the Southeast Interstate Compact (Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia) through the end of 1995. Some states and regional compacts outside that region, including Massachusetts, gained access through June 30, 1994, upon the approval of the Compact Commission. Access beyond these dates is uncertain, and must be authorized by the South Carolina Legislature.
[g] "Slit" trenches are used for the disposal of higher activity LLRW. The narrow trench helps to minimize worker exposure.

New York, and Rhode Island are all "unaffiliated."[7] Maine and Vermont recently agreed to join a new regional compact with Texas. Legislation approving this new compact is expected to be submitted to Congress in 1994. For purposes of this Management Plan, it is assumed that the new Texas-Maine-Vermont compact will be established.

Massachusetts' LLRW management act is recognized by state officials across the country for its comprehensive provisions. The cornerstones of that law are requirements for:

- planning and implementing LLRW management activities in a phased, step-by-step method;
- public participation in all state LLRW management actions; and
- LLRW minimization to the greatest extent achievable by every LLRW generator within Massachusetts.

Chapter 111H created the Management Board as the lead entity responsible for planning and effecting LLRW management. That agency is authorized to site an LLRW storage, treatment or disposal facility within the state, if it determines that one or more such facilities are necessary and appropriate. In addition, the law requires that any LLRW disposal facility must be designed so that the facility can be thoroughly **monitored** and the waste **retrieved**, if necessary.

Chapter 111H also assigns important responsibilities to two other state agencies. The Massachusetts Department of Public Health (DPH), Radiation Control Program, serves as the chief state agency to regulate (i.e., issue licenses, conduct inspections, etc.) users of radioactive materials and any storage, treatment, or disposal facilities which may be sited, developed, and operated under the procedures established in the Act. These duties cannot be conducted by DPH until the state receives "Agreement State" authorization from the NRC which allows the state to assume these functions.[8]

In July, 1992, Governor William F. Weld officially requested the NRC to approve Agreement State status for Massachusetts, certifying that the DPH Radiation Control Program would be "adequate to protect public health and safety." If, after an independent evaluation, the NRC determines that the State's program is adequate and compatible to NRC's regulatory requirements, the NRC will approve the Massachusetts request. When NRC approval is granted, DPH will assume licensing, inspection, and enforcement responsibilities as the chief state regulator of radioactive materials licensees. If Massachusetts never becomes an Agreement State, the licensing functions described in Chapter 111H will continue to be administered by the NRC.

Chapter 111H also requires that the Massachusetts Department of Environmental Protection (DEP) develop siting criteria, which would be used if the Management Board were to decide to site an in-state facility. In addition, the Act requires the Commissioner of DEP to conduct an adjudicatory proceeding requested by any party aggrieved by Management Board siting decisions.

Chapter 111H is divided into six phases, ranging from "planning" (Phase I) to "institutional control"

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[7] Other unaffiliated states and districts include Michigan, Puerto Rico, and Washington, D.C. These entities did not participate in the CONEG negotiations. Nor did the state of Texas, which recently agreed to form a new regional compact with Maine and Vermont.

[8] An NRC-authorized "Agreement" can be either "full" or "limited." A "full" Agreement allows the State to license and regulate most radioactive materials users, including LLRW facilities. A "limited" Agreement provides for state licensing and regulation of disposal facilities, only.

(Phase VI), the period after a facility's closure when the site is monitored for a period of perhaps 300 years or longer.

Other state laws pertaining to LLRW management include the Massachusetts Environmental Policy Act (MEPA), which requires the State to review state-sponsored and state-permitted actions that have major environmental impacts [Massachusetts General Laws c.30, sections 61-62H]; the Nuclear Power and Waste Disposal Voter Approval and Legislative Certification Act, which requires separate approvals by the Legislature and by voters in a statewide referendum before an LLRW facility can be sited in the Commonwealth[9] [Massachusetts General Laws c.164, Appendix, sections 3-1 to 3-9]; and the Toxic Use Reduction Act, that establishes a plan for the Commonwealth to reduce the use of toxic chemicals (that may contribute to "mixed" waste) by 50% by the year 1997. [Massachusetts General Laws c.211]

Local Government Role

Local government involvement in LLRW management is required by Chapter 111H, and is primarily in the form of citizen and municipal government participation, (i.e., public hearings, public comment, review of draft policies and regulations, consultations with state officials, etc.) rather than through the enforcement of municipal by-laws or ordinances, which are pre-empted by state and federal laws and regulations. If a decision is reached to site an LLRW facility, local participation is more expansive, and includes the involvement in the siting process by local Community Supervisory Committees (CSCs), and the selection by the CSC of the facility operator and the facility technology. Local government participation is summarized in Section 6.7 of this chapter, and is detailed in Chapters 2 and 6 of VOLUME II.

6.7 Public Participation: An Essential Ingredient in LLRW Management

[VOLUME II, Chapters 2 and 5]

The public's right to share in the LLRW management process is a key element in the State's LLRW management law. A "Public Participation Coordinator" -- a statutorily required staff position for the Management Board -- is responsible to "encourage and facilitate the participation of interested persons in all of the processes established in or pursuant to" Chapter 111H.

Public participation is important in Massachusetts because of this state's traditions of local home rule and local government volunteerism; it is important to ensure that state and federal agencies assigned LLRW management responsibility are accountable to the public. If in-state facility siting is decided upon, public participation will ensure that the community values and concerns of people most directly affected by any land use decisions, are heard and addressed.

Public participation enables two-way communications among citizens and state officials, regardless of the Management Board's decision to site, or not to site, a storage, treatment, or disposal facility in Massachusetts. All of the public participation requirements contained in the law, divided into the categories of "without facility siting" and "with siting," are identified in Chapter 6 of VOLUME II. The "without facility siting" list includes requirements that:

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[9] This law was passed by referendum in 1982. An advisory opinion issued in June, 1986, by the Massachusetts Supreme Judicial Court suggested that the provisions of this referendum would be unconstitutional in the context of the LLRW management structure established by Chapter 111H. The action by the Legislature in enacting Chapter 111H after this opinion raises questions about the continued applicability of Chapter 503.

- The **Public Participation Coordinator** must establish an advisory group to assist in developing public informational programs relating to radioactive materials use and LLRW generation; involve citizens in public meetings and in the development of the LLRW Management Plan; and expedite arrangements for statewide public hearings on all proposed LLRW management regulations and this master plan.

- The **Management Board** is charged to act "in the public interest," and cannot make certain decisions, such as facility siting, without a two-thirds affirmative vote. All of the Board's meetings must be open to the public, and encourage citizen participation. The initial regulations pertaining to facility siting must be issued in draft form for a 120-day public review period, and be subject to comment at statewide public hearings.

- **DPH** and **DEP** must follow procedures similar to the Management Board in issuing draft regulations, and obtaining public review and comment.

- Representatives of **local government** work with state officials to facilitate community involvement in all processes involving LLRW management. They may serve on the Public Participation Coordinator's advisory committee, participate in public meetings, and comment on the various proposed policies and regulations of each state agency.

- Members of the **public** may be involved in every aspect of LLRW management, depending upon their level of interest. Their input is especially important in the review of various draft documents prepared by the Management Board, DPH, and DEP, and regulations pertaining to this Management Plan, waste minimization, and facility siting, licensing, development, operation, closure, and institutional control.

The "with siting" scenario includes the following additional requirements:

- The **Public Participation Coordinator** must ensure public participation during the site identification process of the Management Board if a favorable vote to site a facility has been conducted.

- Before voting to initiate LLRW storage, treatment, or disposal facility siting, the **Management Board** must issue a notice of its intent to conduct such a vote. If an affirmative siting decision is voted by a two-thirds majority, the Board must notify the Chief Executive Officer of every municipality that site selection has begun. If a "superior site" is ultimately chosen, the Management Board (and its corresponding public interest) will be enhanced by the addition of two Board members representing the site (and possibly a neighboring) community.

- The **Management Board** is also required to keep all municipalities involved during the facility siting process informed of Board activities; establish a field office in the site community; maintain copies of all DPH environmental monitoring records; appoint a "resident engineer" to work in cooperation with site community officials and residents; participate in public meetings, and take other actions designed to engender public participation.

- Before detailed site characterization[10] begins, a local committee, called the **Community**

[10] "Detailed site characterization" is an on-site investigatory and analytical process of studying the hydrogeology and other environmental characteristics of possible sites, over a period of four weather seasons.

Supervisory Committee (CSC), must be appointed by the community's Chief Executive Officer[11] in any municipality where a potential site is identified. Like the Management Board, the composition of CSCs must include individuals who reflect the "public interest" in representing the municipality's concerns relative to environmental protection, public health, community values, and local planning and management. These committees provide for direct involvement and community participation in the siting process, including the significant responsibilities of:

- selecting the company to operate the facility;
- choosing the facility technology (with the exception of shallow land burial, which is expressly banned by state law); and
- negotiating community compensation and facility impact agreements.

- **DPH** must establish a "decision schedule" for each complete facility license application, including the date by which it intends to issue a draft license, draft denial, or final license decision. It must conduct a hearing and provide a 45-day public comment period on the facility license application. DPH must establish a comprehensive environmental monitoring program at the facility site, in consultation with the local Board of Health and DEP. This monitoring program must include training for local citizens and officials, and the local Board of Health may receive "split" samples collected in the program, for separate analysis.

- A **citizens advisory committee** (comprised of CSC members and other citizens) must be appointed by the Secretary of the Commonwealth's Executive Office of Environmental Affairs (EOEA) to aid in developing the scope of the statutorily-required environmental impact report. Any LLRW facility is considered a "major and complicated" project within the review standards of the Massachusetts Environmental Policy Act (MEPA).

- **DEP**'s role in the siting process is to ensure that its siting criteria are properly followed by the Management Board. After the final site selection is made, any aggrieved party may petition DEP to conduct an adjudicatory hearing concerning site selection. Further legal challenges would be referred directly to the Massachusetts Supreme Judicial Court.

- **Local government** officials work with the CSC and local citizens to ensure that municipal concerns are addressed in the siting process, and beyond. The law also provides numerous notification and public hearing requirements to local government. In addition, if a challenge to the site selection process is brought to DEP, the community's expenses in connection with an adjudicatory proceeding would be reimbursed by the Management Board.

- Members of the **public** may exercise their rights in any aspect of facility siting to request information, participate in public meetings, work as part of the CSC or along with it, and to review and comment on all siting documents.

- Another important aspect of Chapter 111H that ensures public trust in the siting process is the provision that DEP and the Management Board **may not waive** the application of the **siting criteria regulations**.

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[11] The "Chief Executive Officer" is the city manager in any city having a city manager, the mayor in any other city, the town manager in any town having a town manager, and the chairman of the board of selectmen in any other town.

6.8 LLRW Produced in Massachusetts

[VOLUME II, Chapter 4]

LLRW is defined in both federal and state law by what it is not. It is neither high-level radioactive waste, nor spent nuclear fuel, nor certain types of byproduct material.[12] It is waste containing certain types and concentrations of radioactive materials as so determined by the federal government, with the exception of LLRW that remains a federal responsibility. In Massachusetts it is only LLRW which was so classified as of the date of the passage of Chapter 111H (Dec. 8, 1987).

The reason for this last provision in the definition -- i.e., waste classified as LLRW as of Dec. 8, 1987 -- is to avoid having the Commonwealth be responsible for regulating any waste not currently LLRW, which federal agencies such as the NRC may decide to incorporate into their definition at a later date, but which state government may feel is inappropriate in the LLRW category. The State definition also ensures that Massachusetts can continue to regulate as LLRW any portions of the LLRW stream which NRC may wish to reclassify in order to reduce or remove its regulatory restrictions.

LLRW generally is contaminated with low, but potentially injurious, concentrations of radioactive materials. Most LLRW emits no detectable heat, and requires little or no shielding to protect handlers from exceeding the exposure levels mentioned above. The majority of LLRW loses its radioactivity in a few months; some will take several hundred and even thousands of years to decay to levels equivalent to those found in everyday, non-radioactive materials and objects.

The types and sources of LLRW generated in Massachusetts are summarized in Table 6-2. The principal radionuclides in Massachusetts LLRW are summarized in Table 6-3 by the non-federal government generator categories of "Commercial, "Academic," "Health Care," "Utility," and "Government" radioactive materials users.

Approximately 100 LLRW generators produce LLRW every year that must ultimately be disposed of in an LLRW disposal facility. In 1991, LLRW generators shipped 42,686 cubic feet of waste to licensed LLRW disposal facilities. In 1992, 119,004 cubic feet were shipped for disposal. This quantity ranked the Commonwealth as the 13th largest producer of LLRW in the country in 1991, and the 11th largest in 1992, in terms of the amount accepted at the three licensed disposal facilities. Even the 119,004 cubic feet, which included over 60,000 cubic feet of decommissioning waste -- not a "typical" annual amount, represents a substantial improvement in waste management practices with respect to previous years. For example, in 1982, Massachusetts LLRW generators shipped 285,952 cubic feet for disposal, placing the Commonwealth first in the nation that year. This volume represents over 6.5 times the volume shipped in 1991, and almost 2.5 times the volume shipped in 1992.[13]

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[12] "High-level radioactive waste" is irradiated nuclear reactor fuel and liquids or solids resulting from the operation of solvent extraction systems in a reactor fuel reprocessing plant. "Spent nuclear fuel" is fuel that has been withdrawn from a nuclear reactor following irradiation, which has not been separated by reprocessing. Other definitions appear in a glossary in VOLUME II.

[13] The ranking noted above is based on DOE data collected on all states that used the commercial disposal sites in Barnwell, South Carolina; Beatty, Nevada; and Hanford, Washington, during 1991 and 1992. DOE does not keep track of waste volume shipped to a fourth disposal site in Clive, Utah. The Management Board has urged DOE to include the Utah volumes for the whole nation, since disposal data without Utah can be deceiving. For example, DOE reported that Massachusetts shipped 56,734 cubic feet for disposal to three sites in 1992. However, generators in the state also shipped 60,486 cubic feet to the site in Utah. The Management Board keeps track of all LLRW shipments, including those to Clive, Utah.

Table 6-2
Principal Generator Categories and LLRW Types Produced in Massachusetts

Commercial LLRW results from commercial activities including the manufacture of radiopharmaceuticals, sealed sources, biotechnology products and biomedical/organic products; research and development; monitoring services; non-destructive testing; production monitoring; and quality control testing. Typical kinds of LLRW produced include:

- Dry Active Waste
- Contaminated Hardware
- Contaminated Aqueous and Organic Liquids
- Contaminated Oil, Rubble, Soil, and Sand
- Filters and Filter Media
- Ion Exchange Resins
- Sludges
- Biological Waste

Academic LLRW is produced in many of the State's universities and other research facilities from activities including research in physics, inorganic chemistry, materials analysis and geology; and radioactive materials use in the classroom for educational purposes. Typical LLRW produced include:

- Dry Active Waste
- Contaminated Hardware
- Contaminated Aqueous and Organic Liquids
- Contaminated Rubble, Soil, and Sand
- Cartridge Filters for Liquids
- Ion Exchange Resins
- Biological Waste
- Liquid Scintillation Waste

Health Care LLRW is produced from the widespread use of nuclear medicine procedures to diagnose and treat diseases. Diagnostic practices include activities such as measuring the uptake of radioactive drugs by various organs in the body; and using "imaging" to distribute radioactive drugs through the body or to certain organs to detect tumors or other abnormalities. Therapeutic procedures include using radioactive drugs internally and externally, as well as implanting radioactive devices on the body's surface. Typical LLRW produced include:

- Dry Active Waste
- Contaminated Aqueous and Organic Liquids
- Liquid Scintillation Waste
- Contaminated Hardware
- Biological Waste
- Gases

Utility LLRW is produced as a by-product of generating electricity in nuclear-powered reactors. Typical LLRW includes:

- Dry Active Waste
- Evaporator Concentrates
- Activated Hardware
- Contaminated Aqueous and Organic Liquids
- Cartridge Filters for Liquids
- Filters and Filter Media
- Contaminated Hardware
- Ion Exchange Resins
- Gases
- Contaminated Oils
- Sludges

Government LLRW comes from government hospitals, municipal water departments, and state agencies such as the DEP Lawrence Experimental Station. Little waste is produced by these activities. Typical wastes include:

- Dry Active Waste
- Contaminated Hardware
- Contaminated Aqueous and Organic Liquids
- Liquid Scintillation Waste
- Biological Waste

Dry Active Waste: paper, cloth, clothing, glassware, plastic (all compactable); metal, concrete, wood, hardware (all uncompacted)
Activated Hardware: control rods, in-core instruments, structural materials
Biological Waste: animal carcasses, tissue

Source: Massachusetts Low-Level Radioactive Waste Management Board.

Table 6-3
Principal Radionuclides in Massachusetts LLRW[a]

Radionuclide	Half-Life	Commercial	Academic	Health	Utility	Government
Hydrogen-3	12.3y	x	x	x	x	v
Sulfur-35	87.2d	x	x	x		
Carbon-14	5730y	x	x	x	x	v
Krypton-85	10.72y	x				
Cesium-137	30.17y	x	x	x	x	x
Uranium-238	4,468,000,000y	x	x	v	v	x
Gadolinium-153	242d	x	x	x		
Iridium-192	73.83d	v	x	x		
Phosphorus-32	14.28d	x	x	x		
Strontium-90	29.12y	x	x	v	v	
Cobalt-60	5.271y	x	x	v	x	x
Iron-55	2.7y	x	x	x	x	
Chromium-51	27.7d	x	x	x	x	
Manganese-54	312.5d	x	v		x	
Cobalt-58	70.8d	x	x		x	
Cesium-134	2.062y	x			x	
Zinc-65	243.9d	x	x	v	x	
Nickel-63	100y	x	v	v	x	x
Iodine-125	60.14d	x	x	x		v
Iodine-129	15,900,000 y	x			x	v
Cobalt-57	270.9d	x	x	x	x	v
Barium-140	12.74d				x	
Technetium-99m	0.25d	x	x	x		

[a] Based on data from annual Massachusetts Low-Level Radioactive Waste Classification surveys.
y = year d = day x = typically used v = use varies from year to year

While the volume of LLRW shipped for disposal has continued to decline since the early 1980s, the activity of the waste has continued to fluctuate. A summary of volumes and activity of LLRW shipped for disposal in the years 1989 through 1992 is shown in Table 6-4.

Table 6-4
Summary of LLRW Shipped for Disposal,[1] 1989-1992

Volume				Activity			
1989	1990	1991	1992	1989	1990	1991	1992
58,717	48,231	42,686	119,004	57,192	111,082	32,531	76,363

[1] Totals may not compare to totals published by others due to differences in reporting, broker treatment not reported by radioactive materials users, and end of year shipments credited the following year.

Source: Massachusetts Low-level Radioactive Waste Management Board. 1990, 1991, and 1992 Low-Level Radioactive Waste Survey Report. Boston, MA, November, 1991; November, 1992; and October, 1993.

6.9 Classifying Low-Level Radioactive Waste

[VOLUME II, Chapter 7]

In 1983, the NRC established a system of classifying waste for disposal by Classes A, B, C, and Greater than Class C (GTCC). The system, which is contained in Title 10, Part 60 of the Code of Federal Regulations (10 CFR 61), is based chiefly upon the radiological hazards of LLRW, although additional requirements in the regulations address chemical and other hazards in a general fashion.

The NRC classification system is based on the concept of identifying wastes generally acceptable for near-surface disposal -- the type of LLRW disposal regarded by the NRC as acceptable from a health and environmental standpoint. The four classes of waste are based on the agency's evaluation of the concentrations and half-lives of various radioactive materials, and acceptable doses to an "inadvertent intruder" (i.e., a person who might come onto a site following its institutional control period, and build a home or begin an agricultural activity, without knowing of the past use of the land).

The concentration limits set in the four NRC disposal classes are required for all types of disposal facilities besides near-surface disposal (often referred to as "shallow land burial"). Therefore, disposal technologies that employ additional protective (or "engineered") barriers can provide even greater protection to the public health and safety, and to the environment.

The four NRC waste disposal classes are:

Class A wastes have low concentrations of long-lived radionuclides and concentrations of short-lived radionuclides that will decay to acceptable levels within a 100-year institutional control period after the facility has closed.

Class B wastes contain higher concentrations of short-lived and long-lived radionuclides. They must meet the NRC's "stability" requirements so that the waste forms or containers can "maintain gross physical properties and identity, over 300 years," thus limiting the potential exposure to an inadvertent intruder.

Class C wastes contain even greater concentrations of short-lived and long-lived radionuclides, and must meet the 300-year waste form requirements to ensure stability, but also protect the inadvertent intruder for 500 years.

Greater than Class C (GTCC) wastes have concentrations of radionuclides which make them

unacceptable for the types of disposal authorized for Classes A, B, and C. GTCC wastes are the responsibility of the federal government, and are not accepted at commercial LLRW disposal sites. Under Massachusetts law, GTCC waste is not considered LLRW.

The EPA uses a system for classifying toxic chemical "hazardous" waste that involves identifying such characteristics as "ignitability," "corrosivity," "reactivity," and "toxicity."[14] The EPA also uses an established list of chemicals the agency has determined to be "hazardous," which was created from chemicals exhibiting "acute hazardous" and "toxic" qualities, in addition to the other characteristics listed above.

Massachusetts law requires a "total hazard" system to classify LLRW. The system developed by the Management Board addresses characteristics of radiological, chemical, and biological toxicity and form. In addition, unlike the NRC or EPA classifications which are used only for **disposal**, the Massachusetts system classifies LLRW for all management activities, including **storage, treatment,** and **disposal**.

6.10 Mixed Waste: Contradictions, Duplication and Confusion from the Dual Regulatory System

[VOLUME II, Chapter 8]

Mixed waste, defined as LLRW which contains or exhibits the characteristics of toxic chemical "hazardous" waste, is a regulatory dilemma due to the dual and contradictory regulation by the NRC and EPA of this small portion of the LLRW stream.

Seven general categories of mixed waste include liquid scintillation fluids,[15] other organic chemicals, lead wastes, chromate and cadmium wastes, chlorinated fluorocarbons (CFCs), water-soluble corrosive liquids, and waste oil. Identifying a mixed waste involves using the EPA's hazardous waste "characteristics" (i.e., ignitability, corrosivity, reactivity, or toxicity) to determine their applicability to the LLRW in question, or checking whether any of its components are named on EPA's hazardous waste "lists."

Both DPH and DEP have applied to their complimentary federal agencies (NRC and EPA, respectively) for approval to regulate mixed waste. In the meantime, however, Massachusetts hazardous waste law, M.G.L. c.21C, allows the independent regulation of mixed waste by DEP, and regulations were promulgated by that agency several years ago as part of DEP's hazardous waste restrictions.

Some of the significant requirements of the DEP regulations which apply to mixed waste in Massachusetts include:

- Three categories of generators are identified for regulatory purposes: "large quantity" generators,

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[14] "Toxicity" is evaluated through an EPA-approved "Toxicity Characteristic Leaching Procedure" (TCLP) test that determines whether a waste is likely to leach hazardous concentrations into the groundwater, if the waste is improperly managed.

[15] Liquid scintillation fluids, also called LSF, or liquid scintillation "cocktails," are chemical solutions (usually organic chemicals) that produce light when bombarded with radiation. Hospitals, universities, biotechnology companies, and other industries use LSF in laboratory procedures, including diagnosis of such diseases as cancer and research on AIDS. They are the largest volume of mixed waste produced nationwide, as well as in Massachusetts.

"small quantity" generators and "very small quantity" generators. The third group, (which produces less than 220 pounds of hazardous waste per month and no "acutely hazardous waste"[16] per month) is **exempt** from all hazardous waste regulations except for registering with DEP (not licensure); identifying whether their waste is hazardous; any DEP determination that the actions of the very small quantity generator may pose an "imminent threat" to public health, welfare, safety or the environment; recordkeeping and package labeling; and providing waste management in a manner protective of the public health, safety, and the environment.

- Mixed waste generators may not transport this waste off site unless they have valid DEP transporter licenses.

- Mixed waste generators must retain packaging and shipping records for three years; large quantity generators must report annually to DEP regarding all shipments off site as well as all mixed waste treated, stored, used, or disposed of on site.

- A "large quantity" mixed waste generator may accumulate waste on site for up to 90 days (in compliance with packaging, container, and labeling regulations), without a DEP storage license. Any on-site storage beyond 90 days requires the generator to have a license allowing storage, and comply with some of the same provisions that apply to hazardous waste storage "facilities."

- A "small quantity" generator may accumulate mixed waste "at or near each specific point of generation" for <u>any length of time</u>, without a license, under certain conditions.

Numerous mixed waste regulatory problems are identified in Chapter 8 of VOLUME II. For example, some NRC/DEP regulations overlap, like the requirements that mixed waste generators hold two licenses, adopt two financial assurance standards, establish two sets of employee training guidelines, and conduct two differing record-keeping procedures to track their waste.

Some regulations are contradictory, like the requirements for handling liquid mixed wastes. Because LLRW regulations prohibit the disposal of liquid wastes, LLRW generators customarily solidify their mixed waste for either storage for decay, or storage for ultimate disposal. However, the DEP standard (patterned after an EPA rule) for treating most liquid organic mixed wastes is incineration. While liquid wastes which first have been solidified with absorbents or other materials <u>can</u> be incinerated, this process is more expensive and more burdensome than the direct incineration of liquid waste.

Another contradictory set of regulations involves the issue of on-site storage of mixed waste containing short half-life material until the radioactivity decays to background levels, allowing the waste to be managed as a <u>hazardous waste</u>, only. DEP regulations prohibit the use of on-site storage for decay as a treatment technique -- a policy which, in the case of mixed waste, lacks any environmental justification.

Some regulations have forced mixed waste generators to be in violation of the DEP rules, because they have no alternatives for managing their waste. For example, DEP regulations prohibit on-site storage of mixed waste unless the waste has been treated, but treatment facilities are not generally available nationwide, so generators are forced to store their waste on site for lack of any other options. If mixed waste is treated, DEP regulations allow on-site storage for an unlimited period. However, NRC regulations <u>prohibit</u> storage for more than five years.

Certain regulations set different levels of protection. The most obvious regulations in this category

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[16] Many hazardous wastes have been listed by EPA or state regulators like DEP as being "acutely hazardous," due to their danger to human health and the environment.

are those relating to the types of disposal facilities allowed for mixed waste. DEP's hazardous waste regulations allow landfill disposal, if double liners and leachate collection systems are installed. However, the State's LLRW management law prohibits landfills if they rely on the sites' natural characteristics as the primary barrier for waste isolation. Many would argue that double liners are not a "primary" barrier for the long-term segregation of LLRW.

Another example of different protection is the dissimilar requirement for institutional control. NRC requires up to a minimum 100-year institutional control period during which an LLRW disposal facility is maintained and monitored, after closure. If problems arise at the site, funds are available throughout that period, and even longer (perhaps up to 500 years), if so determined by the sited state during facility operation. On the other hand, DEP requires only a 30-year period of maintenance and monitoring, after closure. After that time, funds for mitigation cease to be available, and the facility can be used for other purposes. Any mixed waste put into a DEP-regulated hazardous waste facility would not meet the stricter standards of the NRC.[17]

Some regulations can cause increased occupational exposure. For example, DEP requires that any waste whose toxicity levels are uncertain be subject to the TCLP test.[18] In the case of many solid mixed wastes, like lead waste, the TCLP test requires that the materials be "ground up" for sampling to particle sizes no larger than 9.5 millimeters. In addition to the fact that no laboratory in the country will grind sealed radioactive sources which contain lead shields, this DEP regulation contradicts an NRC standard, which prohibits containers holding radioactive sources from being breached.

Some of the problems of managing mixed waste are being ameliorated by new mixed waste treatment companies who are getting the proper permits to be able to treat this waste. Once treated, much of the waste can be disposed of as hazardous waste only, or be incinerated as non-hazardous fuel (under EPA regulations).

6.11 LLRW Treatment Practices

[VOLUME II, Chapter 10]

A chief component of state law requires users of radioactive materials that produce LLRW as a by-product of various activities to identify and use treatment methods to reduce the radioactive sources that lead to LLRW, and to minimize the volume of waste once it is generated. "Treatment" is defined as:

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[17] NRC's requirement of "no more than" 100 years of institutional control implies that this monitoring period could be shorter, perhaps less than the 30-year period required by DEP/EPA. However, for all practical purposes, the institutional control period is the maximum of 100 years, as planned for all existing disposal sites and all newly developing ones in other states. Massachusetts law requires the institutional control period to be "not less than the minimum time required for any LLRW present at the site to decay to the maximum concentrations above natural background levels permitted to be released into air or water in unrestricted areas under federal and state law." [Chapter 111H, section 46(b)] Unless certain wastes were removed from a Massachusetts disposal facility, this requirement could extend the institutional control period beyond 100 years.

[18] The Toxicity Characteristic Leaching Procedure (TCLP) test exposes waste material to an acidic environment as a means of predicting which materials in the waste may leach into groundwater. If materials released exceed levels set by the EPA, the waste is considered legally hazardous and must be handled as such.

"any method, technique, or process, including source minimization, volume minimization and storage for decay, designed to change the physical, radioactive, chemical or biological characteristics or composition of LLRW in order to render such waste as safer for management, amendable for recovery, convertible to another usable material or reduced in volume." [Chapter 111H, section 1]

Various **procedures** to achieve source and waste volume minimization (S/WVM) and elimination, where feasible (S/WVM/E) include:

Administrative Policies and Procedures. These should begin with a clear policy statement in support of S/WVM/E. The policy should be issued by the chief executive officer, and include specific goals and implementation strategies for department managers and other employees.

Design and Engineering of Building Space and Equipment. Sound design and engineering practices during planning and construction of the company or institution's facility can ensure, for example, that proper materials are used to prevent or reduce contamination, and that machinery that will become contaminated is isolated from equipment which will not require direct contact with radiation sources. Remote operations, or removable, compartmentalized equipment, can be incorporated into a plant's design to reduce contamination when the facility is in use. Plant design should provide for areas where contaminated items, such as tools, can be reused without causing further contamination.

Operation and Maintenance. Some of the activities during operation and maintenance, which can minimize sources generating LLRW and waste volumes, include coating equipment with protective surfaces (such as plastic, or strippable paint) which can be removed, allowing the equipment to be decontaminated rather than disposed of. Using alternatives other than organic chemicals to clean radioactively-contaminated equipment can avoid the generation of mixed waste. Controlling the purchases of radioactive materials to avoid "overpurchases" and optimizing inventory control can eliminate waste generation from unused source materials. Training can ensure that O&M employees are fully aware of procedures to reduce LLRW generation.

Decontamination and Decommissioning. Decontamination and decommissioning are S/WVM "procedures" as well as "technologies" (described below). Decontamination can reduce radiation exposure, reduce the amount of waste requiring disposal, and extend the life of plant equipment. Methods of controlling contamination can reduce the time, labor, and materials necessary to perform decontamination. Carefully selecting decontamination cleaning solutions, where available, can avoid the generation of mixed waste. Decommissioning removes the activities, equipment, and structures involved in the use of radioactive materials, and reduces residual radioactivity to allow property to be available for unrestricted use.

There are a number of LLRW volume-reducing **technologies** in use in Massachusetts. These are briefly summarized as follows:

Storage for Decay. This technique allows LLRW containing radionuclides with relatively short half-lives to be held for natural radioactive decay so that the resulting material can be disposed of as essentially non-radioactive trash. This method is widely used; in 1991, 38,219 cubic feet of LLRW was treated through the storage for decay method, and in 1992, 41,229 cubic feet -- thereby eliminating the need for any of this waste to be sent to an LLRW disposal facility. This storage for decay procedure works for mixed waste containing short half-life radionuclides. However, due to prohibitions on storing certain mixed waste, this treatment procedure cannot lawfully be utilized.

Compaction and Supercompaction. Depending upon the type of compaction (and supercompaction) used to compress LLRW material into smaller volumes, LLRW quantities can be reduced to approximately one-fifth of their original size. Mechanisms have been developed for use on containers

holding compacted waste, to prevent the waste from springing back to its prior size after compaction pressure is released. Two commercial supercompaction facilities used extensively by Massachusetts LLRW generators are both located in Oak Ridge, Tennessee (Scientific Ecology Group (SEG), and Quadrex).

Segregation. By sorting and segregating uncontaminated waste from that which is radioactively contaminated, a significant decrease in LLRW volume occurs. Users of radioactive materials have to be encouraged also to separate short half-life waste from longer-lived waste, where possible, so that the first group can be stored for decay, while the second group will constitute a smaller volume requiring shipment for disposal.

Shredding. Paper, cloth, plastics, and some light metals can be shredded into smaller pieces to aid in compaction and incineration.

Incineration. The volume reduction factors from LLRW incineration are greater than any other treatment technology, producing reductions ranging from 30:1 to 100:1 before ash immobilization and packaging. After packaging, volume reduction continues to be up to five times greater than any other volume minimization technology. Incineration at out-of-state treatment facilities, such as one run by SEG in Oak Ridge, Tennessee, is used regularly by Massachusetts generators. The SEG facility is capable of processing about 1,600 pounds of dry waste per hour, and advertises volume reduction factors of 100:1.

Most incineration of Massachusetts-produced LLRW occurs out of state, where several commercial facilities provide this service. However, a few licensees -- principally hospitals and universities in the Commonwealth -- are licensed to operate small on-site incinerators for their own waste. In addition to incinerating its own waste, one of these licensees also incinerates waste from several affiliated medical institutions.[19]

Another advantage of incineration besides volume reduction is that is can destroy some organic hazardous wastes and polychlorinated biphenyls (PCBs) which may contaminate a small portion of LLRW (i.e., mixed waste). By eliminating the hazardous component of the mixed waste through incineration, what remains can more easily be managed as LLRW. In addition, incinerated LLRW is more stable for disposal. Disadvantages of this treatment technique include concerns about risk of environmental and public health damage from the release of toxic and radioactive gases into the atmosphere.

Filtration is a process of removing solid particles from liquid LLRW by forcing the liquid through a porous material. It is used by the nuclear power industry and other generators to remove solids from process water and to remove radioactive materials from gas emissions.

Ion Exchange. This technology uses chemical resins to transfer (i.e., exchange) the atoms in radioactive material with the atoms in the resin material, in order to remove radionuclides from liquid LLRW.

Evaporation. By using heat to evaporate water out of radioactive material, the resultant waste will be volume-reduced. A similar type of technique, called crystallization, precipitates solids out of liquid LLRW.

Flocculation. This technique uses chemicals to gather small particles of waste, which are suspended in liquid, into larger particles or clusters.

Precipitation removes particles of dissolved solids from liquid LLRW, and changes them into a solid waste. Only the radioactivity of the dissolved solids is removed by this process.

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[19] Harvard University operates an incinerator for itself and 15 affiliated institutions, including Massachusetts General Hospital, Brigham and Women's Hospital, Children's Hospital, and others.

Sedimentation is a process similar to precipitation, except that it works by gravity, not chemicals.

Centrifugation. This technology removes suspended solids using centrifugal force to separate solids from liquids.

Drying. Various types of dryers are marketed to use heat to remove liquid and form a dry solid.

Dewatering uses pumps or gravity to draw water from wet solids through filter devices.

Decontamination. This technique removes radioactive contaminants from the surface or near-surface of objects, such as floors, walls, tools, equipment, and from liquids. Decontamination cleaning solutions are used to transfer the radioactively-contaminated material to the cleaning solutions.

Another volume-reduction method involves returning the radioactively-contaminated item to the manufacturer, where it can be held for decay, processed for reuse, or disposed of.

Some LLRW treatment technologies do not accomplish volume reduction, but provide other benefits, such as stabilizing the waste for safer management. The NRC's requirement for "stability" in its LLRW disposal facility regulations is intended to avoid some of the poor waste disposal techniques of the past. The agency's stability rules ensure that:

(1) LLRW does not structurally degrade and affect the overall stability of the site through slumping, collapse, or other disposal unit failure which could lead to water infiltration;

(2) LLRW will maintain its physical dimensions and form under such disposal conditions as the presence of moisture and microbial activity at the site, and chemical changes inside the package; and

(3) better protection is provided for an "inadvertent intruder" who may occupy the site after all institutional controls have ended.

Solidification is a technique of mixing materials with LLRW as it is placed in disposal containers so that it becomes a stable, solid block. Common solidifiers include cement, asphalt, plastics, and polyethylene. Polymerization is a chemical process that solidifies liquid and solid waste using chemical polymers.

6.12 Analyzing Treatment Technologies and Practices

[VOLUME II, Chapter 11]

This Management Plan is required by law to analyze LLRW treatment technologies and practices according to their potential health, safety, and environmental impacts; their climatic, geologic, and hydrogeologic requirements; their suitability for LLRW managed within the Commonwealth; and their cost-effectiveness.

Potential Health, Safety, and Environmental Impacts. There are a number of such impacts, most of which are positive ones, since treatment of LLRW can render it safer for management, thereby reducing the potential that waste will harm the public, cause public safety problems, or damage the environment. The potential positive impacts of treatment include:

(1) reducing the potential that radionuclides in the waste may be released during storage, transportation, or disposal;

(2) eliminating the radioactive contaminants or the hazardous chemical contaminants (or both) of LLRW;

(3) reducing waste volumes requiring storage, transport, or disposal;

(4) changing liquid LLRW into solid or semi-solid form for greater control; and

(5) reducing the potential for waste to react negatively with its container, thereby increasing the ability of the waste package to contain the waste over a longer period of time.

There are also some potential negative health, safety, and environmental impacts of waste treatment, although they are considered to be negligible if treatment technologies are properly designed and operated. On-site treatment can:

(1) potentially increase the exposure of radiation safety workers;

(2) increase the possibility of spills or other releases;

(3) concentrate radioactivity, potentially forcing changes in packaging and transportation to handle higher activity levels; and

(4) cause accidents from the use of heavy equipment or toxic chemicals that could lead to environmental releases, worker exposure, fires, or explosions.

The potential negative impacts of off-site treatment include those identified for on-site treatment as well as:

(1) the potential for accidents to occur during the shipment of LLRW to treatment companies;

(2) a second set of radiation workers possibly exposed to waste at the treatment site;

(3) the potential that off-site incidents can be more serious where larger quantities of LLRW are treated for multiple generators; and

(4) the potential that off-site treatment will increase LLRW transport on Massachusetts roads when the Barnwell, South Carolina disposal facility ceases to be available and all off-site treated waste[20] will have to be shipped back into Massachusetts for storage by the generator.

Treatment technologies need to be housed in locations which are environmentally sensitive, and must be engineered to provide multi-layer environmental protections.

Incineration of LLRW has the potential to produce gaseous effluents that must be trapped to remove both the radioactive materials and any hazardous chemicals produced as a result of combustion. Some radioactive materials, such as Carbon-14 and Hydrogen-3 (tritium), are more difficult to trap in the gaseous

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[20] All LLRW will have to be shipped back to the generators after treatment, except for LLRW that can be shipped for disposal at the Envirocare disposal site in Clive, Utah. Envirocare's license restricts it to accepting only low-activity LLRW and mixed waste.

outflow, because incineration changes them to radioactive carbon dioxide and radioactive water, some of which may be released to the atmosphere during burning operations.

Regulations set limits on the concentrations of radionuclides allowed to be released to the atmosphere. In addition, continuous monitoring can ensure proper operation.

Climatic, Geologic, Hydrogeologic, or other Requirements. Effluents from some treatment processes require that several climatic, geologic, hydrogeologic, or other environmental factors be considered in siting treatment facilities. The buildings themselves need to be located in areas that are not environmentally sensitive, and must be engineered to provide numerous environmental protections. Any centralized treatment "facility" sited in Massachusetts would be subject to myriad environmental requirements during site identification, including environmental reviews and facility design and performance standards required by DPH.

Unlike storage or disposal, LLRW does not remain at a treatment facility for very long. It therefore has less opportunity to leach into a water supply or contaminate the soil, if proper steps are taken to prevent waste releases from the treatment units.

Suitability. The treatment of LLRW using technologies and practices described in this LLRW Management Plan is considered "suitable" or appropriate for waste produced in Massachusetts. Treatment can enhance some waste characteristics for subsequent waste management activities. Treatment may make some LLRW safer for management, allow some LLRW to be recycled or reused, and reduce waste volume for ultimate disposal. In addition, treatment is "suitable" because state law requires LLRW generators to utilize all appropriate methods to reduce the radioactive sources that lead to LLRW, and to minimize LLRW after it is produced.

In some cases, however, treatment can have undesirable results. For example, treatment technologies that reduce waste volume and increase concentrations of activity can cause the waste to be reclassified from a lower class to a higher one, for example, from Class A to Class B or C. Such reclassification could require changes in packaging to handle both transportation and disposal of the higher levels of activity.

In addition, LLRW is currently shipped to out-of-state treatment facilities, and then transported to two disposal sites, with most waste going to Barnwell, South Carolina. After the Barnwell disposal facility is no longer available, the treated waste will have to be shipped back to Massachusetts, for interim storage on the premises where it was produced. Even though LLRW transportation has proven to be extremely safe, additional shipments back to the Commonwealth increase the potential for accidents to occur. These disadvantages are minor, however, in comparison to the advantages offered by LLRW treatment.

Cost-Effectiveness. The cost of on-site treatment is borne predominately by LLRW generators. This cost can be offset by reduced costs for packaging, storage, shipping, and disposal. The State's costs relating to on-site treatment, should Massachusetts become an Agreement State, will include the licensing, permitting, and inspecting of treatment operations.[21] The costs of off-site treatment out of state also are paid by LLRW generators, except for the State's present costs of randomly inspecting transportation shipments, and providing emergency response.

The cost to the Commonwealth of a centralized LLRW treatment facility within Massachusetts would be significant, due to the costs of facility siting, licensing, environmental monitoring, insurance, and other factors. Various factors impacting those costs are described in detail in Chapter 11 of VOLUME II, and are

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[21] However, these costs are expected to be reimbursed to the Commonwealth in licensing fees.

among the many factors that must be evaluated in siting an LLRW treatment facility within Massachusetts.

6.13 Regulations Allowing Alternative Management Techniques

[VOLUME 2, Chapter 10]

NRC regulations allow certain types of waste management, disposal, and discharges other than disposal in licensed LLRW disposal sites.[22] By allowing these alternative management methods, the volume of LLRW requiring disposal in a licensed disposal facility is greatly reduced. These regulated alternative methods include:

Storage for Decay. The NRC allows waste to be stored on site for a maximum of five years. Waste containing radionuclides with half-lives that will decay to background levels within this time period (i.e., half-lives less than approximately 150 days) can, therefore, be treated in this manner, resulting in waste containing essentially no radioactivity.

Case-by-Case Disposal Exemptions. NRC regulations allow licensees to bury small quantities of low activity LLRW on site. Each application is considered on a case-by-case basis. Of the 41 requests to use this method since the rule has been in effect, only 23 have been approved nationwide, including one in Massachusetts. In order to receive approval for on-site burial, the licensee must submit an application that includes an analysis of the environment at the site, including topographical, geological, meteorological and hydrological characteristics, and the utilization of ground and surface waters in the area. While the NRC maintains this alternative disposal method in its regulations, the agency has discouraged its use ever since the regulations for commercial LLRW disposal facilities took effect in 1983. The one Massachusetts licensee authorized to use this method discontinued on-site burial in the mid-1980s.

Discharges to Sewer Systems. NRC regulations prohibit the discharge of licensed radioactive material or waste into sewer systems except for very small quantities which the agency believes will be diluted by the volume of sewage and water flowing through a system. No more than one curie per year may be discharged in this manner, per licensee, except for Carbon-14 (C-14) and Hydrogen-3 (tritium). Up to one curie per year of C-14, and as much as five curies per year of tritium may be released into the sewer system by each licensee.

Release in Effluents to Air or Water. NRC allows radionuclides in radioactive materials or LLRW to be released in effluents (air or water) as long as the release remains within the radiation dose limits allowed by regulation for occupational and public doses. Appendix B to 10 CFR 20.1001 through 20.2401 includes tables showing allowable "annual limits on intake" (ALIs) and derived air concentrations (DACs), and the chemical form of each radionuclide. The concentration values given in Table 2 of Appendix B (effluents: air or water) are equivalent to the radionuclide concentrations which, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of 50 millirem.

Exempt Quantities. Minute quantities of certain radionuclides do not have to be disposed of in

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[22] These regulations apply to Massachusetts LLRW generators, since they are presently licensed by the NRC. After Massachusetts becomes an Agreement State, these practices will likely continue to be permitted, unless DPH proposes more stringent regulations than currently apply. In the case of NRC's "exempt quantity" regulations, DPH would not be allowed to modify them, as these rules are classified as "Division I compatibility" items, which means that Agreement States are required to adopt NRC's standard essentially verbatim.

licensed LLRW disposal facilities under NRC regulations. Up to 0.05 microcuries (a millionth of a curie) of tritium or C-14 in liquid scintillation fluids, and up to the same amount of the same radionuclides per gram of animal tissue (averaged over the weight of the entire animal) may be disposed of as non-radioactive trash.

6.14 "Below Regulatory Concern"

[VOLUME II, Chapter 10]

In 1990, the NRC proposed to modify its "exempt quantities" standard by establishing a level of radioactively-contaminated waste that would be considered "below regulatory concern" (BRC), thereby allowing this waste to be disposed of in unlicensed LLRW sites, such as municipal landfills. Strong opposition to the 1990 policy statement developed among environmentalists, citizens, and generators alike, who felt the NRC proposal exceeded an appropriate dose level for its proposed BRC standard. Among the opponents to the BRC standard were both nuclear-powered utility companies in Massachusetts, which publicly stated their opposition to using local landfills for the disposal of unregulated LLRW.

Several states passed laws banning the unregulated disposal of BRC waste. Massachusetts law already has "frozen" the definition of LLRW -- so that BRC could have been excluded without legislative authorization -- and the Management Board expressed the Commonwealth's opposition to the proposed standard. The NRC shelved its BRC proposal in 1992.

The EPA has also proposed a BRC standard, which is lower than the one proposed by the NRC. It is unclear, however, whether either of the two federal agencies will ever establish a BRC rule. In 1992, Congress approved a provision in a federal energy reorganization law that prohibits NRC from establishing such a rule.

6.15 Packaging and Shipping LLRW

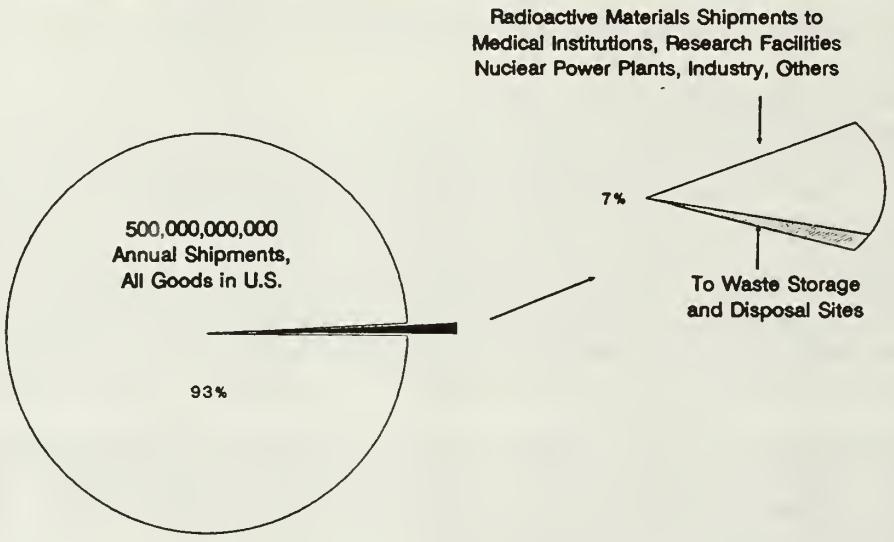
[VOLUME II, Chapter 9]

Among the 500 billion shipments of all kinds of products transported annually throughout the United States are approximately three million shipments of radioactive materials. Of those, about 140,000 (7%) involve LLRW shipments (Figure 6-B). Of the more than 3,080,000 shipments of LLRW in the last 22 years, involving millions more packages than this total number of shipments, only five transportation accidents have involved the release of any LLRW -- a remarkable LLRW transportation record.

The U.S. Department of Transportation (DOT) is the chief authority overseeing radioactive materials shipments and LLRW transportation, with responsibilities for: developing the overall safety standards governing all LLRW packages, classifying them for various uses, and their marking and labeling. Safety standards also involve the mechanical conditions of the transportation equipment; driver qualifications; loading and unloading; handling and storage (during shipment); the placarding of transportation vehicles; tracking and manifest requirements; and notification and reporting of transportation incidents and accidents[23] which may involve radioactive contamination. DOT's regulations appear in Title 49, Parts 100-

[23] An "incident" is the actual or suspected release of radioactive materials, or surface contamination which exceeds regulatory standards, on either the package or the transport vehicle. An "accident" involves the vehicle transporting the waste and can range from a minor accident to a major collision. An "accident" does not involve the release or suspected release of radioactive material.

Figure 6-B
Radioactive Materials and Waste Shipments as a Percentage of All Annual Shipments



Source: U.S. Department of Energy. Transporting Radioactive Material, DOE/DP-0064, Washington, DC, August, 1989.

199, of the Code of Federal Regulations [49 CFR Parts 100-199].

In addition, the NRC regulates certain aspects of LLRW transportation, principally shipments of spent fuel from nuclear-powered utility plants (i.e., high-level radioactive waste); "highway route controlled quantities" of LLRW requiring special packaging; the use of specially designated "preferred routes;" extra driver training; and pre-notification of each shipment. NRC also provides technical assistance to the DOT and aids in inspections, enforcement, and investigations of incidents and accidents.

DOT's packaging regulations are designed to protect the public, LLRW package handlers, and drivers of LLRW vehicles, by limiting radiation emissions on the package surface, and by requiring increased package strength and durability as the amount of radioactivity increases in the container. Package standards involve three general considerations:

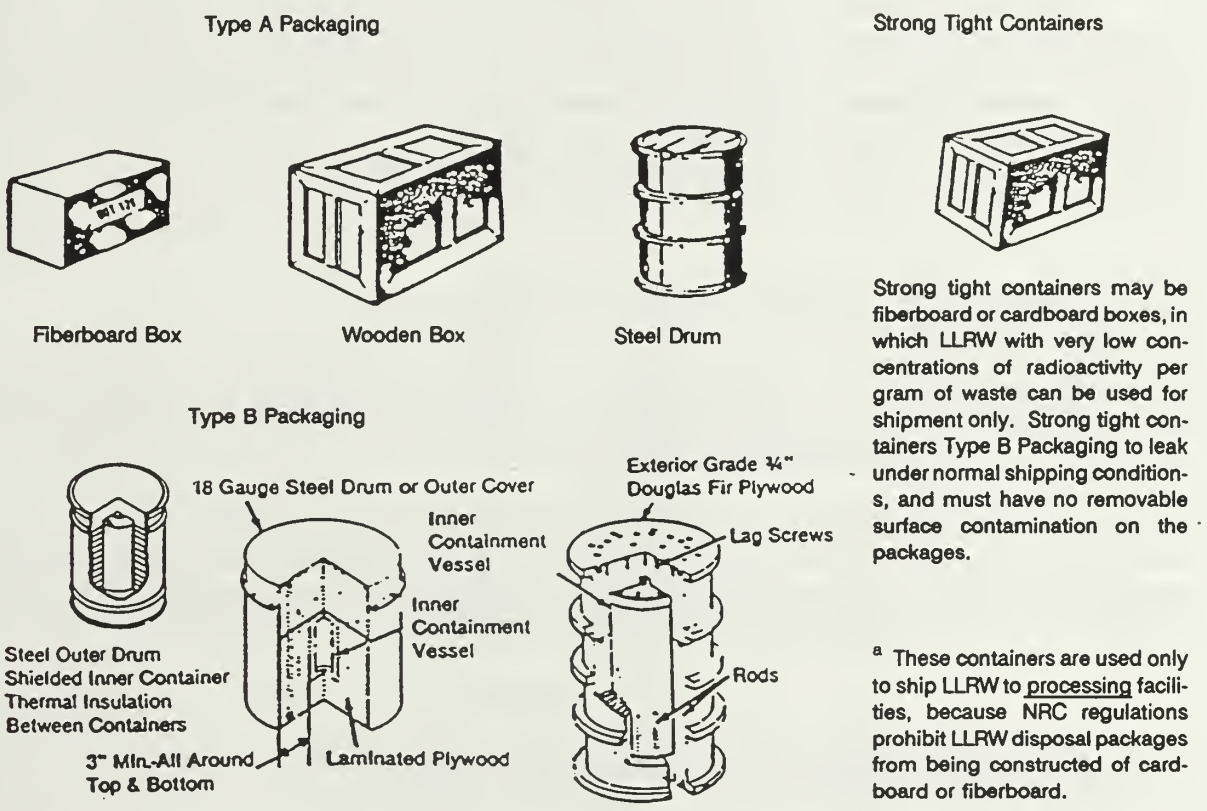
(1) the specific radionuclides to be shipped, as each varies to the degree of hazard involved;

(2) the quantity of radionuclides to be shipped, as more concentrated radioactive materials and wastes require more protective packaging; and

(3) the form of the radionuclides, which is determined by various tests that measure durability (impact, percussion, bending, heat, and leaching assessment tests).

An empty shipping container for LLRW is called "packaging;" a container full of LLRW is called a "package." Three basic package types prescribed by the DOT and NRC for LLRW are "Type A," "Type B" and "strong tight containers," as shown in Figure 6-C. (The Type "A" and "B" containers do not relate to the NRC's disposal Classes A or B.) Each package type is designed so that the concentration of curies of any specific radionuclide allowed in the container is limited by the degree of safety built into the container. Most of the LLRW shipped in Massachusetts is packaged in Type A containers, and generally take the form of 30-

Figure 6-C
Typical Packaging for LLRW Shipment[a]



Source: U.S. Department of Transportation.

or 55-gallon steel drums with heavy-duty closure devices.

All LLRW packages, and certain types of LLRW shipments, must be marked. Identifying markings on packages are called "labels;" markings on shipping vehicles are called "placards." In addition, all LLRW shipments must be inventoried with shipping papers, which must remain accessible to the driver at all times, facilitate the location of a shipment, and identify its contents en route to its destination, as well as after its arrival.

At the state level, the Massachusetts Department of Highways, which is responsible for regulating activities on public roads, has adopted DOT regulations involving radioactive materials and waste shipments as part of the larger category of "hazardous materials" regulations. [720 Code of Massachusetts Regulations (CMR) 8.00] With certain minor exceptions, Department of Highways regulations prohibit vehicles from transporting LLRW (and radioactive materials) through the tunnel on the John F. Fitzgerald Expressway (Southeast Expressway) located beneath Dewey Square in Boston. The Department of Highways also requires permits for overweight or oversized trucks carrying any types of shipments, including LLRW, and restricts these shipments to certain routes.

In addition, the Massachusetts Turnpike Authority regulates LLRW shipments on the Turnpike. Vehicles transporting LLRW are permitted on all parts of the Turnpike except the Callahan and Sumner tunnels in Boston. Any overweight or oversized vehicles carrying LLRW must have special hauling permits, and are prohibited from using the Turnpike's "Boston Extension" during morning and evening rush hours.

Some localities in Massachusetts, and certain other states, have adopted by-laws and regulations to attempt to supplement federal transportation rules. These regulations cover shipping routes; permitting requirements; prenotification; prohibitions on hours of travel; accident notice requirements; and inspections. However, as a result of numerous challenges to the federal authority over state and local rules, Congress adopted amendments to federal transportation law in 1990, which clearly denote that the DOT and other federal agencies have pre-emptive authority on most all transportation issues.

6.16 Emergency Preparedness and Response

[VOLUME II, Chapter 9]

Even though the record of LLRW transportation has been exceedingly good, there is still some potential risk involved in moving LLRW. Consequently, emergency preparedness and response measures are important components of effective LLRW management.

The Massachusetts Emergency Management Agency (MEMA) and DPH are the lead state agencies involved in these activities. MEMA develops and reviews emergency planning and support services; DPH operates the "NIAT" (Nuclear Incident Advisory Team), which coordinates emergency response, determines the hazards associated with a transportation event, and the necessary response actions.

6.17 Analyzing Storage Technologies and Practices

[VOLUME II, Chapter 12]

"Storage" is defined as the "holding of LLRW for treatment or disposal." [Chapter 111H, section 1] Storage may occur at a number of locations: on site where LLRW is produced, or off site at a broker or processing plant, a storage facility, or an LLRW disposal facility prior to disposal. The length of the on-site storage period is limited by each user's individual possession license, and currently allows between two to five years of storage under existing NRC regulations. However, that storage period is undergoing review by the NRC in light of the expected unavailability of disposal facilities nationwide after June, 1994.

Of the approximately 450 radioactive materials users licensed in Massachusetts, 199 stored waste on site in 1991, and 207 stored waste on site in 1992, according to the Management Board's 1991 and 1992 surveys. Waste is stored on site for a number of reasons. Many Massachusetts LLRW generators use "storage for decay," a treatment technique that allows LLRW containing relatively short half-life material to be stored to allow the natural radioactive decay process to occur. When the decay process is complete, the essentially non-radioactive waste can be disposed of as conventional solid waste. Another reason for storing LLRW is to accumulate enough for one package, so that it may be shipped for treatment or disposal. An additional reason for storage is the unavailability of treatment and disposal for some types of mixed waste.

There are a number of methods or technologies used to store LLRW. They involve the types of packages used for storage, and any additional structural, protective barriers. Most of the waste produced in Massachusetts can be packaged so that the radioactivity is uniformly distributed throughout the package,

or so that only a small percentage of radioactivity is concentrated in the waste. The containers holding this LLRW prevent the release of radioactivity, without the need for additional "shielding." Other LLRW which contains higher concentrations of radioactivity requires additional, protective shielding. Shielding can be accomplished by placing the same package type used for lower concentrations of radioactivity into cement casks called "overpacks," using specially-designed "High Integrity Containers" (HICs) made of concrete and steel, or storing waste in storage buildings specifically designed for this purpose.

Other storage technologies include storage sheds, outdoor concrete pads, unshielded buildings, and shielded storage modules or bunkers (i.e., concrete "boxes" with removable concrete covers).

The State's LLRW management law requires an analysis of LLRW storage technologies and practices according to their potential health, safety, and environmental impacts; their climatic, geologic and hydrogeologic requirements; their suitability for LLRW managed in the Commonwealth; and their cost-effectiveness.

Potential Health, Safety, and Environmental Impacts. Potential adverse health, safety, and environmental impacts exist for LLRW storage, especially for long-term, on-site storage. However, the magnitude of such on-site storage safety hazards depends upon the type of waste in storage, the types and concentrations of radionuclides in the stored waste, how readily they may enter the environment, and to some extent, the length of time the waste remains in storage. Impacts include:

(1) the potential for greater occupational exposure due to increased radioactivity in storage, and the need for periodic inspection of stored waste;

(2) the possibility of fires, explosions, package corrosion, or other incidents due to chemical reactions;

(3) the potential for spills, if liquid LLRW is stored;

(4) the prospect of unsuitable storage locations or unsafe storage design that could allow radioactive wastes to enter the environment;

(5) the potential for health, safety, or environmental damage during the decontamination and decommissioning of areas used for extended interim storage; and

(6) the potential for operating problems to result in the release of radiation due to inexperience in managing greater quantities of radionuclides for extended periods.

The aspects of LLRW storage technologies and practices that can be advantageous to environmental protection include:

(1) waste is easily retrievable if a problem arises;

(2) the integrity of waste containers is not a problem during storage, with proper handling and management; and

(3) new treatment procedures may be developed while waste is in storage that can enable waste to be recycled for reuse; or can further reduce or eliminate the chemical properties of certain wastes, thereby reducing the total amount of waste requiring disposal.

While LLRW can be safely stored for both short and long periods, storage may be safest and most protective of the public health, safety, and the environment in a centralized storage facility which is sited,

designed, and operated by individuals trained for this purpose alone. Environmental problems of LLRW storage can also be diminished through regular inspections and enforcement by regulatory agencies.

Climatic, Geologic, Hydrogeologic, or other Requirements. These environmental factors should not be major considerations for waste stored in accordance with all regulatory requirements within buildings or areas established and monitored for storage. However, these may be appropriate considerations for the outside storage of waste in unshielded sheds or atop concrete slabs, where the potential exists for waste containers to crack or corrode, and waste form to degrade.

Climatic, geologic, hydrogeologic, and other environmental conditions would need to be studied in connection with the siting, development, and operation of a centralized storage facility. These environmental factors would have to be considered during site identification, site characterization, the environmental review prior to approval of a facility license, and the evaluation of facility design and performance specifications of any draft license issued.

Suitability. The suitability of using various storage technologies and practices for the LLRW managed within the Commonwealth depends upon a number of factors, including:

(1) the availability of storage and disposal facilities;

(2) the inventory of radionuclides and waste forms requiring storage;

(3) the ability to monitor storage areas;

(4) the capital and operating costs of various storage technologies;

(5) the environmental impacts of storage;

(6) the public health and safety considerations of storage; and

(7) the political and social implications of storage policy.

Storage for decay, a procedure used by over 70% of the radioactive materials users in Massachusetts, is encouraged as a storage and treatment technology. Interim storage, both on-site and centralized, may be suitable depending upon the conditions following such storage, for example a negotiated agreement with another state to accept Massachusetts waste for disposal. Long-term storage (over five years) on site may be unsuitable because of NRC prohibitions against this activity. However, off-site centralized storage can be a "suitable" short-term management option. Since the NRC will not allow storage to take the place of disposal, centralized interim or long-term storage should be weighed against storage plus disposal, evaluating such factors as the environmental suitability and economics of both options.

Cost-Effectiveness. The costs to the State of LLRW storage will depend upon the type of storage practice chosen. If storage occurs on site where the waste is produced, the radioactive materials users will finance most of the related expenses. Once Massachusetts becomes an Agreement State, the Commonwealth's costs should be modest, including such activities as inspection and enforcement; additional personnel for these and other regulatory responsibilities; the costs of licensing the use of radioactive materials, including those in storage; and costs to provide technical assistance.

The cost-effectiveness of centralized storage depends upon a number of variables, including availability of LLRW disposal facilities, facility size, site identification, waste form, radionuclide composition, the numbers of LLRW generators needing such a facility, insurance costs, etc.

The cost-effectiveness to LLRW generators also depends upon a number of variables, including a comparison of the costs of other alternatives such as relocating their businesses to other states. Because storage is an "add-on" to the costs of disposal, and disposal will still be required for all waste containing radionuclides that cannot be reduced to background levels through storage for decay, the cost-effectiveness needs to be evaluated in the context of available disposal options.

Additional details on these storage evaluations, on existing storage activities in Massachusetts, and on federal and state storage regulations can be found in Chapter 12 of VOLUME II.

6.18 Decommissioning

[VOLUME ii, Chapter 14]

The decommissioning plans currently under development for the Yankee Rowe nuclear powered electric generating plant, and the current decommissioning activities involving the old research reactor at the U.S. Army Materials Technology Laboratory (AMTL) at the Watertown Arsenal are focusing attention in Massachusetts on reactor decommissioning. However, decommissioning applies to all facilities where radioactive materials are used, though different restrictions apply depending upon the type of facility involved. For example, some sites must submit decommissioning plans to the NRC for approval; some must propose plans for financing their decommissioning projects at the same time they initially petition for a license to use radioactive materials at their site.

Decommissioning is designed to safely remove from service the activities, equipment, and structures involved in the use of radioactive materials, and to reduce residual radioactivity so that the property may be released for "unrestricted use." The removal of radioactive materials and waste from a location does not apply just to LLRW; mixed waste, spent nuclear fuel, high-level waste (HLRW), and other types of radioactive wastes, if existing on the site, can also be involved. In addition, the removal or management of hazardous chemicals or waste at the same location would also have to be addressed not as a requirement in NRC regulations, but as a matter of NRC policy. The NRC cooperates with other federal and state agencies, to ensure that all applicable requirements are completed, before a site can truly be considered to be safe for "unrestricted use."

Three Decommissioning Methods

Three NRC-approved decommissioning processes are used, depending upon the type of facility. The DECON method involves removing or decontaminating all radioactively-contaminated parts of the site, including structures and equipment, immediately after ceasing use of radioactive materials. DECON is the fastest of the three methods, and can result in higher occupational exposure levels than do the other two methods. Larger amounts of radioactive waste can result from this method, because little or no waste has been stored for decay to reduce the volume of radioactive waste requiring disposal.

The second NRC-permitted method, SAFSTOR, involves: (1) a short period of planning and preparation; (2) a variable storage period of continuing care, surveillance, and security; and (3) a short period of deferred decontamination. SAFSTOR up to 60 years is allowed for nuclear power plants, with NRC approval. This decommissioning method has its advantages over DECON, in minimizing both radiation exposure to workers at the site, eliminating the immediate need for waste disposal, and reducing future waste volumes. Disadvantages include the increased cost of personnel for active maintenance, surveillance, and security, and the retention of the site as a restricted radiation area.

The third decommissioning method, ENTOMB, allows radioactive contaminants to be encased in

a structurally rigid and long-lived material, like concrete, until radioactivity decays to a level that allows the unrestricted use of the property. The advantages of this procedure include the reduction of worker exposure; the disadvantages are the same as those of SAFSTOR. Evaluations of decommissioning alternatives have led the NRC to conclude that ENTOMB is not a practical decommissioning alternative for nuclear reactors.

The impacts of decommissioning activities on the State's efforts to manage LLRW depend upon the decommissioning sites involved. For example, in the case of the U.S. Army's Watertown site, the Army's efforts to remove an estimated 154,000 cubic feet of LLRW from the Arsenal site before the end of 1992, for disposal in Barnwell, South Carolina, has a beneficial impact upon the Commonwealth's or Watertown's ability to reuse that site for other purposes, such as economic development. In the instance of the Yankee Rowe decommissioning, Yankee Atomic's decision to shut down the plant eight years early, at a time when Massachusetts has access to the disposal site in Barnwell, South Carolina, has enabled Yankee to dispose of some of its decommissioning waste so that it will not be any burden on the State. However, the unavoidable delays in Yankee's decommissioning, due to a lack of LLRW, HLRW, and spent fuel disposal facilities, mean that Massachusetts will likely become responsible for the disposal of much of the 95,000 cubic feet of LLRW containing approximately 192,000 curies of activity. Yankee is currently effectuating a project to dispose of several reactor components, which will reduce the final waste volume requiring disposal to 80,000 cubic feet, containing less than 10,000 curies.

The operator of the Yankee Rowe plant anticipates that the SAFSTOR method can be used to delay the remainder of decommissioning until the year 2,000, when the company believes both LLRW and HLRW disposal facilities will be available. However, the decommissioning of the Yankee Rowe plant may not be completed for a decade or more beyond that date, when federal disposal facilities for HLRW and spent fuel will be available, and shipping of these wastes will be completed from the Rowe site. Therefore, while the utility's nuclear reactor and other on-site power facilities can be "removed safely from service," the entire property cannot be released "for unrestricted use" unless the HLRW and spent fuel can be removed.

Another impact relating to the Yankee Rowe decommissioning decision has been its negative effect upon discussions between Massachusetts and other states that are siting new LLRW disposal facilities regarding possibilities of an out-of-state disposal arrangement. For apparently political reasons, (which are nonetheless real), many of the states developing new disposal capacity are currently unwilling to accept LLRW from the first commercial nuclear power plant decommissioning in the nation.

Other impacts relate to waste handling, waste packaging, interim storage, radiation dose to workers and the public, transportation of decommissioning waste, the environment, and the volume of decommissioning waste requiring disposal, if Massachusetts determines that an in-state facility is needed for this purpose.

6.19 Old Burial Sites Undergoing Decommissioning

[VOLUME II, Chapter 14]

Decommissioning pertains to the removal of radioactive waste at formerly licensed sites, as well as at those with current licenses. It also pertains to clean-up activities where radioactive waste was legally or illegally disposed of in unlicensed LLRW disposal sites. Some of these sites are being decommissioned by the U.S. Department of Energy (DOE); some are being cleaned up by the present site owners.

One DOE environmental restoration program that includes decontamination and decommissioning throughout the nation is the Formerly Utilized Sites Remedial Action Program, or FUSRAP. This activity

cleans up sites that were previously used to support nuclear research operations of old federal agencies, including the Atomic Energy Commission and the Manhattan Engineering District, the latter group having supported the federal government's secret research work to produce atomic bombs during World War II (Manhattan Project).

Two FUSRAP sites exist in Massachusetts, and are estimated to involve a total of 193,283 cubic feet of LLRW. Because these site decommissionings are a federal responsibility, all of this LLRW will go into DOE disposal sites, unless the DOE can arrange for some or all of the waste to be accepted at state disposal facilities. The two sites are:

(1) Shpack Landfill, Norton. Decommissioning of the contaminated soil, concrete, metal, and rubble, totalling 10,782 cubic feet, is planned to begin in 1995-1996.

(2) Ventron Co., Beverly. Clean-up is partially finished to remove the radioactively-contaminated soil, concrete, metal, and rubble amounting to 182,501 cubic feet. Completion is scheduled for 1994-1995.

In addition to the FUSRAP sites, six other locations in Massachusetts are among approximately 50 sites selected nationally by the NRC for "accelerated" decommissioning, due to concern about the potential long-term impacts from possible groundwater contamination; the need to remove large quantities of contaminated equipment, structures or soils; and the necessity to clean up sites where liability issues have slowed decommissioning progress. The six in the Commonwealth, which are described in greater detail in Chapter 14 of VOLUME II, are:

(1) Watertown Arsenal, AMTL and Mall. Following 20 years of SAFSTOR, remaining contaminated research reactor material, structures, equipment and soils are being removed by the U.S. Army. Target completion date: June, 1996.

(2) General Services Administration, Watertown Arsenal (North). Some decontamination and decommissioning work was conducted in 1988, but has not be completed. The U.S. Army Corps of Engineers is conducting a new assessment of additional decommissioning requirements, and the NRC has requested additional characterization of a portion of the site. Target completion date: July, 1994.

(3) Engelhard Co., Plainville. Both the NRC and EPA are overseeing the activities leading to a cleanup of hazardous waste, LLRW, and potentially mixed waste at this site, where contamination was discovered as a result of a hazardous waste site investigation. If the present cleanup schedule is followed, the site will be available for "unrestricted use" in mid-1995.

(4) Nuclear Metals, Inc., Concord. DEP and the NRC are coordinating their efforts to get NMI to remove about 750,000 pounds of copper and depleted uranium from an unlined holding basin on their site. The company has argued against removal (to an LLRW disposal site) because it continues to try to find a technology which can remove and recycle the metals from the basin material. Negotiations over the best course of action are on-going.

(5) Texas Instruments, Attleboro. About 68,000 cubic feet of LLRW predominantly composed of contaminated soils, was dug out of the site and shipped for disposal during 1992 and 1993. If the NRC confirms that all radiation levels are at or below NRC's requirements, the site will be released for "unrestricted use" in March, 1994.

(6) Wyman-Gordon Co., Grafton. The NRC asked Wyman-Gordon to conduct a dose assessment study to evaluate the potential of groundwater contamination from the radioactive magnesium-

thorium alloy buried on site between 1958-1970. Wyman-Gordon declined to perform such an assessment, but offered any available data to NRC. A draft NRC dose assessment, completed in February, 1993, indicated that future doses from the buried magnesium-thorium could exceed 1,000 millirem per year.

6.20 Analyzing LLRW Disposal Technologies and Practices

[VOLUME II, Chapter 13]

LLRW "disposal" is defined by Massachusetts law as the isolation of the waste from the biosphere inhabited by human beings and their food chains. [Chapter 111H, section 1] "Disposal" in Massachusetts is really more like very long-term storage, because state law requires the Commonwealth to monitor and retrieve any LLRW that contains radioactive contaminants which have not decayed to the maximum concentrations above natural background levels permitted to be released into air or water in unrestricted areas under federal and state law, at the end of a disposal facility's institutional control period (i.e., perhaps 300-500 years). Unlike most states where disposal means eventually "forgetting" the waste, Massachusetts law requires the retrieval of long-lived waste, or a continuous period of monitoring and maintenance in institutional control.

In establishing its land disposal requirements in 1983, the NRC assumed that "near surface" burial facilities would be appropriate for LLRW disposal. One type of "near surface burial" is "shallow land burial." Massachusetts law explicitly prohibits LLRW disposal by shallow land burial, defined as any disposal technology that relies on the natural characteristics of the land as the "primary" barrier for waste isolation. And, as noted, the Massachusetts statute requires that any LLRW disposal facility must permit the waste to be **monitored** continuously and **retrieved** if necessary.

If the Management Board determines that an LLRW disposal facility is necessary to be sited within the Commonwealth, the facility would be sited, designed, constructed, and operated using the more stringent requirements of state law, because they meet, and exceed, the minimum federal requirements set by NRC regulation.

NRC requires that every LLRW disposal facility meet four minimum performance objectives. They are:

(1) Any radioactive material that leaves the disposal facility and enters the general environment through groundwater, surface water, air, soil, plants, or animals must not result in an annual dose exceeding an equivalent of 25 millirem to the whole body, 75 millirem to the thyroid, and 25 millirem to any other organ of any member of the public. This limit compares to a yearly national average of 360 millirem received by an individual from natural and man-made radiation sources.

(2) A disposal facility must be designed, operated, and closed to ensure that any person who inadvertently enters the facility disposal area (after the institutional control period ends) and decides to build a home or to farm on the site, thereby potentially contacting the waste, will not receive more radiation than 500 millirem to the whole body in one year.

(3) A disposal facility must be operated in compliance with the radiation protection standards established by the NRC in 10 CFR 20 except for the maximum allowed exposure from releases of activity identified in (1), above.

(4) A facility must be sited, designed, used, operated, and closed to achieve long-term structural stability so that ongoing, active maintenance and repairs will not be necessary. The facility must be structurally sound so that only surveillance, monitoring, or minor custodial care are required.

Technical Siting Criteria

In addition, if a disposal facility is determined to be needed in Massachusetts, technical requirements for identifying a disposal site and licensing and operating a disposal facility are contained in state law as well as in NRC regulations. The pertinent Massachusetts statute relating to LLRW disposal, Chapter 111H, requires any site to satisfy the following technical siting requirements:

(1) Sites shall be capable of being characterized, modeled and monitored;

(2) Sites shall be well-drained and free of areas of flooding or frequent ponding; waste management areas[24] shall be outside any 100-year flood plain, coastal high-hazard area, or wetland;

(3) Upstream drainage areas shall be minimized to decrease the amount of run-off which could erode or inundate the waste management area;

(4) Sites shall provide sufficient depth to the water table so that groundwater intrusion, perennial or otherwise, into the waste will not occur;

(5) The hydrogeologic unit used for waste management shall not discharge groundwater to the surface within the site;

(6) Waste management areas shall be located so that tectonic processes in the vicinity, such as faulting, folding, seismic activity or volcanism, will not occur which will significantly effect the ability of the site to meet any performance objectives adopted by the DPH relative to environmental and human exposure to radiation, or preclude adequate modeling and prediction of long-term impacts;

(7) Waste management areas shall be located so that surface geologic processes in the vicinity (such as mass wasting, erosion, slumping or weathering) will not occur which would significantly affect the site's ability to meet DPH's performance objectives, or preclude adequate modeling and prediction of long-term impacts;

(8) Waste management areas shall be located so that nearby activities will not adversely affect the ability of the site to meet any DPH performance objectives or significantly impair the environmental monitoring program;[25]

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[24] A "waste management area" is "that portion of a facility where low-level radioactive waste has been, is being or will be treated, stored or disposed of." The "site" is the entire parcel of land which makes up a facility, including buffer areas between the waste management area and the facility boundary, and areas which are occupied by structures and equipment.

[25] The "environmental monitoring program" is defined as a "program established by DPH, after consultation with DEP and the board of health of each site community, for the purpose of collecting and analyzing environmental data prior to construction and throughout the construction, operation, closure, post-closure observation and maintenance, and institutional control [phases] of a facility." Federal regulations

(9) Sites shall be located in areas with no known economically recoverable resources which, if exploited, would adversely affect the ability of the site to meet any DPH performance objectives or significantly impair the environmental monitoring program;

(10) Sites shall be located outside of, and so as not to adversely affect, the recharge zones of existing or future drinking water source aquifers;

(11) Sites shall have sufficient land available to provide for the waste volume and a reasonable buffer around the waste management area;

(12) Sites shall be located so as not to adversely affect any national park, monument, lake shore, endangered species habitat, or area protected by the federal Wilderness Act, the federal Wild and Scenic Rivers Act, the federal Fish and Wildlife Coordination Act, or the federal National Historic Preservation Act, and

(13) Sites shall be located away from any structure or area in which are regularly found persons who, because of their age or physical characteristics, are likely to be at significantly higher than normal risk of adverse health effects if exposed to the release of radioactive or associated toxic materials.

"Retrievable" Disposal Technologies

Ten LLRW disposal facility technologies which could, under certain conditions, pass the "retrievability" requirement in state law include: below-ground modular concrete canister disposal, below-ground vaults, vaults in a mined cavity, borehole or augered holes, above-ground vaults, above-ground vaults with earthen cover, above-ground modular canisters, above-ground modular canisters with earthen cover, above-ground vaults with modular canisters, and combinations of these technologies which provide multiple barriers.

Each of these technologies is characterized in Chapter 13 of VOLUME II of this Management Plan. Many of these disposal methods utilize "vaults" constructed of reinforced concrete, masonry blocks, fabricated metal or other materials; or "modular concrete canisters" which are cylindrical, reinforced weather-tight concrete containers that hold several waste packages.

Also described are technologies which would not meet the requirement that all waste in a disposal facility must be "retrievable." These unsuitable technologies include shallow land burial, hydrofracture, intermediate depth disposal, and earth-mounded concrete bunker disposal.

This Management Plan is required by law to analyze LLRW disposal technologies and practices according to their potential health, safety, and environmental impacts; their climatic, geologic, and hydrogeologic requirements; their suitability for the LLRW managed within the Commonwealth; and their cost-effectiveness.

Potential Health, Safety, and Environmental Impacts. These impacts exist in both favorable and unfavorable terms. On the positive side, any vault or canister system that provides an additional strong, structural barrier against the potential of radionuclide release from waste packages could enhance the disposal technology's ability to minimize the release of radionuclides for longer periods of time than disposal

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describe these monitoring activities as "pre-operational" monitoring, monitoring "during construction and operations," and "post-operational" monitoring. The pre-construction monitoring must last a minimum of 12 months.

technologies which do not incorporate these barriers. Waste can be isolated from air, water, and the ground for as long as these structures retain their integrity.

A potential negative impact for the disposal technologies that utilize vaults and canisters, however, is the possible increased exposure to workers which could occur, due to the necessity to place high-activity LLRW into canisters or vaults and seal these structures in an exacting manner.

While all materials used to construct vaults or canisters are assumed eventually to fail, this occurrence can be monitored, which can ensure that waste is retrieved or that the barriers are reconstructed before that time.

Above-ground vaults and canisters can be visually inspected and more easily monitored to ensure that no damage to the environment or public health and safety occurs. However, climate can adversely affect their structural integrity. Below-ground technologies do not have the visual monitoring capacity, but their segregation from man can reduce the potential for radiation exposure.

Mined-cavity disposal containing vaults or canisters placed inside can enhance the natural barrier of protection provided by the rock and other material around the mine. Mines receive less damage from earthquakes and seismic activity. However, this type of disposal technology is more difficult to monitor, and great care must be taken to ensure that mine construction does not crack or weaken the rock surrounding the cavity.

Climatic, Geologic, Hydrogeologic, or other Requirements. No matter what type of disposal technology may be chosen, these factors must be considered very carefully in the site selection process. No LLRW disposal unit can be placed over a drinking water supply, or into a wetland, for example, just because the technology uses engineered vaults or canister barriers.

An NRC study cites weather exposure as the greatest natural hazard affecting above-ground technologies, regardless of the engineering design and construction.[26] For example, climate can affect steel-reinforced concrete. While concrete structures built thousands of years ago still exist in the world today, their exposure to such climatic conditions as acid rain and fluctuating temperatures has affected their resilience.

Below-ground disposal technologies must rely heavily on favorable geologic and hydrogeologic conditions to ensure that waste that may accidently escape from the engineered barrier will not contaminate groundwater. Hydrogeology is especially critical for mined-cavity disposal, where a shaft or slope mine could penetrate the water table, and a drift mine could be located either above or below the water table in a hill or mountain. High water tables or radically fluctuating water table levels would need to be avoided for below-ground disposal designs.

Suitability. The suitability or appropriateness of the various LLRW disposal technologies identified here for LLRW managed in the Commonwealth would, ultimately, be decided by the site community, if a disposal facility site were identified in the Commonwealth and advanced to actual implementation.

In general, the hydrological conditions present in Massachusetts may pose a challenge to the suitability of any below-ground disposal technology. In addition, the requirement of retrievability may be more easily achieved using above-ground technologies rather than those below-ground (with the exception

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[26] Bennett, R.D. and Warriner, J.B., U.S. Army Engineer Waterways Experiment Station. Alternative Methods for Disposal of Low-Level Radioactive Wastes, NUREG/CR-3774. U.S. NRC, Washington, DC, October, 1985.

of vaults or canisters inside mined cavities).

Above-ground disposal technologies have appeal for use in Massachusetts because of the State's hydrogeology. The shallow depth of the water table increases the chances that groundwater would serve as a pathway for exposure if waste were placed below-ground, and a leak occurred. An above-grade system, therefore, may provide greater protection for the public and the environment. And, above-grade facilities provide easier retrieval, if it were to become necessary.

Cost-Effectiveness. The responsibility for selecting a disposal technology belongs to the site community, which can be expected to choose the disposal methodology that best protects the health and safety of its residents, and the environment. The selection of the technology accompanies the community's choice of the facility operator, and its responsibility to advise the Management Board during negotiations with the operator for a contract that assures community compensation and benefits. Considerations regarding the cost-effectiveness of the disposal technology, therefore, may not necessarily be a principal factor in the community's decision on disposal technology selection.

The Management Board needs to provide the community with technical advice in order to assist the municipality in making its choice of disposal technologies. The Board's analysis of site characteristics, and the appropriate types of technologies which could be utilized at the site, will be valuable in the site community's deliberations.

Evaluating which disposal "practices" are cost-effective requires a similar analysis of the costs of siting, building, and operating disposal technologies within the state versus the costs of arranging for LLRW disposal out of state. The most cost-effective solution for the Commonwealth in terms of dollars expended might, at first, appear to be a scenario in which the state pays nothing and the LLRW generators pay everything.

However, such a scenario could negatively impact the state economy and the jobs base if LLRW generators chose to relocate to states that already have disposal capacity available, and therefore, lower disposal costs. In response to a 1991 Management Board survey, approximately two-thirds of the businesses, hospitals, universities, and others licensed to use radioactive materials indicated that over $3 billion in revenues associated with that use benefitted the Massachusetts economy.

In-State vs. Out-of-State Disposal

Comparing the practices of in-state versus out-of-state disposal for purposes of cost-effectiveness requires the evaluation of four disposal options: (1) developing an in-state facility for Massachusetts LLRW only; (2) developing an in-state facility as a regional disposal site available to several other states; (3) utilizing a disposal facility in another state with Massachusetts joining a regional compact; and (4) entering into a contractual arrangement (rather than a regional compact) with another state or region. The third option, above, is not currently available to Massachusetts generators. The fourth option is available temporarily through a contract with the Southeast Interstate Compact Commission to use the Barnwell, South Carolina, disposal site. Negotiations continue for a long-term contract with South Carolina or another state or states.

A nationally accepted economic model[27] has been used to develop approximate costs for three types of in-state facilities (above-ground vaults, below-ground vaults, and below-ground modular concrete canisters) and four sizes of disposal facilities: a 35,000 cubic feet per-year "Massachusetts only" LLRW facility, a 50,000 cubic feet per-year "Massachusetts-only" LLRW facility, an 80,000 cubic feet per-year small

[27] U.S. Department of Energy. Disposal Site Economic Model Users Guide for Personal Computers. Idaho Falls, ID, March, 1988.

Table 6-5
Approximate Costs of Three Disposal Technologies for Four In-State Disposal Facility Sizes
(Costs in 000's)

	Facility Phases						
Facility Type and Annual Capacity	Pre-Operation	Initial Construction	Operation	Closure	Post Closure	Total Life Cycle	User Fee, $ per cubic feet
Above-Ground Vaults							
35,000 cubic feet	39,517	7,984	222,175	4,682	53,600	383,400	365
50,000 cubic feet	40,049	8,638	222,565	4,786	53,600	387,030	258
80,000 cubic feet	40,527	9,292	248,001	5,591	59,600	416,730	174
467,000 cubic feet	44,685	21,044	560,524	12,666	135,000	789,480	56
Below-Ground Vaults							
35,000 cubic feet	39,998	8,452	192,299	5,454	33,600	349,560	333
50,000 cubic feet	39,836	9,720	192,331	5,764	33,600	352,380	235
80,000 cubic feet	40,172	10,581	209,321	5,999	36,600	373,080	155
467,000 cubic feet	44,343	21,304	421,597	12,633	73,700	633,780	45
Modular Concrete Canisters							
35,000 cubic feet	39,883	11,464	186,386	6,202	43,300	351,690	335
50,000 cubic feet	40,262	47,906	182,996	6,797	43,300	353,460	236
80,000 cubic feet	40,640	14,046	199,006	7,397	47,000	374,280	156
467,000 cubic feet	96,386	28,279	401,475	14,894	95,300	637,290	46

Source: EG&G Idaho, Inc. Disposal Site Economic Model User's Guide for Personal Computers. Idaho Falls, ID, March, 1988, and updated with Massachusetts factors.

in-state regional facility capable of accommodating LLRW from several small-volume-generating New England states, and a 467,000 cubic feet per-year large in-state regional facility for all of the Northeast or potentially other states. The calculations incorporated a recent Management Board estimate of pre-operating costs to site an in-state disposal facility. Table 6-5 summarizes these estimated disposal costs, including total life-cycle expenditures and user fees.

These estimates are comparable to those identified in other states currently undergoing disposal facility siting. Texas presently anticipates spending $41 million in pre-operational costs for a below-ground, modular concrete canister facility with a two million cubic foot capacity and a 30-year operating life. The total life-cycle costs of that facility are estimated to be $249 million, and the user fee to be $195 per cubic foot for the first 20 years of operation. Development costs for the Central Interstate Compact facility (Illinois) are $75 million;[28] for the Southeast Compact (North Carolina), $84 million; and for the Appalachian Compact (Pennsylvania), $57 million.

These costs can be compared to the pre-operational costs for one of the conceptual Massachusetts disposal facilities illustrated in Table 6-5, which range from $39.5 million to $45.2 million.

Were Massachusetts to be successful in negotiating a contractual arrangement with one of these states or regions, or others developing disposal facilities, a very likely condition might require Massachusetts to subsidize some or all of the pre-operational and operational costs. From discussions with various states about access to their facilities, indications are that such entry fees could range as high as $40 million to $100 million.

In addition, surcharges on user fees could substantially increase the per-cubic foot charge paid to out-of-state facilities by LLRW generators. Also, transportation costs to sites more distant than Massachusetts would add to the cost of using such facilities.

The costs to develop a disposal facility in Massachusetts are not unlike those expected or experienced to develop facilities in other states. In either case, it is likely that the development of a disposal facility in the Commonwealth will result in higher disposal fees for Massachusetts generators than they have incurred in the past. However, as noted in Table 6-5, facility size affects user fees. Were Massachusetts to charge an entry fee to other states under the "small regional" or "large regional" facility options, user fees from the Commonwealth's LLRW generators could be further reduced.

6.21 Insurance Protection for LLRW Facilities

[VOLUME II, Chapter 18]

Any LLRW storage, treatment, or disposal facility sited under the provisions of the State's LLRW Management Act must have adequate insurance to protect against liability claims.

Chapter 111H requires a comprehensive set of insurance protection standards for any such facility, including provisions for financing facility maintenance, remediation, and protection of the public health, safety, and the environment.

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[28] The $75 million cited here was the approximate amount spent by Illinois to site its facility in Martinsville. The facility was disapproved, however, by the Illinois Siting Commission, and Illinois has begun anew to find another site.

Responsibility for maintaining the integrity of the facility lies with the facility operator during facility construction, operation, closure, and post-closure.[29] The operator must collect user fees in accordance with a schedule approved by the Management Board, adequate to ensure that sufficient funds are available for this responsibility. However, in the event that a catastrophe occurs at the facility, for which all funds, including federal assistance, are exhausted, the Commonwealth will ensure that the necessary cleanup and stabilization will occur.

In addition, Chapter 111H holds all persons who transport, treat, store, dispose of, or otherwise manage LLRW, to the standard of strict liability for any harm to the person, land, or property of another (so-called "third-party liability") due to a release of or exposure to LLRW or associated toxic materials. Liability of such persons involved in LLRW management activities may also be joint and several,[30] unless an LLRW generator, transporter, facility operator, or other party can establish that only a portion of the harm resulted from such activity.

The facility operator's funds to cover such third-party claims must be at least the maximum amount available from the nuclear insurance pools or other commercial insurers. In addition, a contingent liability trust account is available to compensate for third-party injuries if all other funds, insurance, and tort compensation have been exhausted.

Beyond these protections, the Commonwealth's LLRW management law provides that the Management Board, Community Supervisory Committees, DPH, and DEP -- all of whom are "public employers" under the state's Tort Claims Act -- can be held liable for the negligent acts of employees acting within the scope of their employment. While the Tort Claims Act, M.G.L. c.258, generally limits liability to $100,000 for each claimant, Chapter 111H expressly waives that limit, and serves as a "pledge" that the Commonwealth will guarantee full liability coverage.

These multiple layers of financial protection are intended to provide the greatest possible assurance that any injured parties will be compensated fairly.

6.22 Economic Impacts of Activities that Produce LLRW

[VOLUME II, Chapter 4]

Chapter 111H requires this LLRW Management Plan to evaluate the economic benefits to the Commonwealth associated with the products, services, and activities of LLRW generators.

Economic information was collected by the Management Board through a supplement to its 1991 annual survey of all radioactive materials users in the Commonwealth, and will be updated again in the 1994 survey. The data collected reveal that revenues exceeding $3 billion dollars result directly from the use of radioactive materials. In addition, over 16,000 employees in the state are "directly involved" in the use of

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[29] The "post-closure" phase of a facility is that period during which active monitoring and maintenance occur, after a facility ceases accepting LLRW, in preparation for transferring the facility's license from the operator to the Commonwealth.

[30] The rule of "joint and several" liability allows an individual bringing a claim for damages to recover from one or more defendants who may have contributed to the harm, either separately or together. Under this rule, in the absence of other identifiable responsible parties, a defendant may have to pay all damages suffered by the plaintiff, even though that defendant actually caused only a portion of the harm.

radioactive materials, and more than 19,000 are "indirectly involved," for a total of over 36,000 jobs relating to radioactive materials use and possible LLRW generation. The economic benefits of these revenues and jobs must be evaluated in developing and implementing LLRW management policy.

6.23 Economic Impacts of an LLRW Facility on a Community and a Property Owner

[VOLUME II, Chapters 16 and 17]

Another issue affecting LLRW management is one that impacts the financial situation of any community that may become the site for an LLRW storage, treatment, or disposal facility. There may also be economic consequences on the landowners whose property abuts such a facility.

Many states in the process of developing LLRW disposal facilities provide compensation and impact payments to site communities. Massachusetts law includes provisions for both types of payments.

"Compensation" offsets burdens borne by a site community; "impact payments" provide monies, services, or other tangibles over and above the municipality's expenses to have the site within its borders. Compensation and impact payments ensure that if a widespread benefit to society is achieved from siting an LLRW facility, then the site community must realize an overall benefit, as well.

Compensation often includes one or more of the following:

- grants to assess the impact of a proposed facility on the municipality;
- property tax payments for the land and the facility, which are not usually paid in connection with state-owned facilities;
- monetary payments to compensate for health and environmental risks;
- community-wide health monitoring programs;
- property value guarantees;
- payments or equipment for emergency services;
- road improvements;
- insurance or contingency funds;
- funds to monitor facility operation and closure; and
- other types of compensation identified by the site community.

Impact payments can include:

- purchase of park land or other lands for public purposes;
- representation on the facility governing board;

- payments for municipal facilities such as schools, libraries, swimming pools, etc.;
- agreements to "hire locally;"
- agreements to purchase supplies, materials, and equipment locally;
- lump-sum payments;
- assistance in enhancing the economic development potential of a community;
- "tipping fees" based on volume or other factors of LLRW accepted at a facility;
- local authority to shut down the facility under certain circumstances; and
- payments for other impacts identified by site and neighboring communities.

Under Massachusetts law, there are a number of stages in the siting of an LLRW storage, treatment, or disposal facility when compensation and impact payments to the site community (and also possibly to neighboring communities) are considered. Some of the arrangements for compensation are tied to public participation, such as the sizable level of funding provided to the candidate site Community Supervisory Committees (CSCs) to evaluate independently such work as site characterization and environmental studies, by retaining technical consultants and other advisors.

Once the final, "superior" site has been selected -- after the Management Board reviews all the environmental data from the site characterization studies -- the Superior Site CSC would continue to receive financial assistance from the Management Board to fund additional work on tasks including:

- choosing a company to operate the facility;
- selecting the type of facility technology best suited for the site and the site community; and
- consulting with the Management Board and the operator during the negotiations to develop a comprehensive operating contract.

One important role for the Superior Site CSC in selecting the facility operator is to ensure that the very best package of compensation and impact payments is incorporated into the facility's comprehensive operating contract. There are explicit statutory provisions for compensation contained in Chapter 111H. However, the law also allows flexibility to the CSC and the Management Board for the purpose of enabling contract negotiations to produce the specific impact payments and compensation sought by the site, neighboring, and affected[31] communities, and abutters to the site.

The package of impact payments and compensation in the comprehensive operating contract is required by law to include:

- the provision that the site community receive property tax payments from the facility operator

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[31] An "affected" community is one, other than the site community, which is identified in an Environmental Impact Report that can be expected to experience significant impacts as a result of the location, development, operation, or closure activities of a facility. A "neighboring" community is a community, other than the site community, which, according to the most recent census, has at least 20% of its population residing within three miles of any superior site.

from the time of the issuance of a facility license through all the years of facility development, operation, closure, post-closure observation and maintenance, and institutional control;[32]

- an annual payment to the site community (and possibly to neighboring communities, depending upon the location of the facility) during facility operation, based upon the amount of waste accepted into the facility;

- $150,000 per year from the time the facility opens and ending five years after the issuance of the facility license;

- all agreements the facility operator made during initial negotiations with the CSC; and

- all agreements made by the Management Board for the benefit of the site, affected or neighboring communities, such as obligations to reimburse a community for road maintenance or reconstruction or other increased infrastructure costs resulting from facility siting, development or operation.

The precise agreements between the site community and the operator, and the site community and the State, are left to the negotiations process. They can include items identified in the typical "compensation" and "impact payments" lists, above, such as community-wide health monitoring programs, payments or equipment for emergency services, or purchase of park lands.

In addition to compensation and impact payments available to the local governments of site, affected, and neighboring communities, the Management Board determined that a property value guarantee program should be available to property owners within a defined "Property Value Protection District."

If siting is initiated, this facility operator-funding program will provide: (1) a pledge of property value protection for properties surrounding each candidate site that will undergo detailed site characterization, and (2) a specific property value guarantee for properties surrounding whichever candidate site is chosen as the superior site, once the facility receives a license.

Other provisions of the property value protection program are in Chapter 17 of VOLUME II.

6.24 The Risks of Siting LLRW Facilities; the Consequences of Improper LLRW Management

[VOLUME II, Chapters 1, 3, and 16]

A site community would be affected by the risks and disincentives involved in siting an LLRW facility. Whether these risks are real or perceived, they still exist, and involve:

- LLRW storage;

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[32] State law exempts state property from local property taxation. However, Chapter 111H provides that the site community is to receive property taxes beginning after the State acquires the facility property. In addition, the Act requires the facility operator to pay property taxes, even though the operator only leases the property from the State, commencing with the issuance of an approved facility license. The facility operator is responsible to make property tax payments until the facility license is transferred to the State during the institutional control period, at which time the payments are assumed by the State.

- LLRW transportation;
- facility operations such as loading and unloading LLRW packages;
- the potential for radiation exposure to facility workers;
- the potential for exposure of non-nuclear hazards to facility workers;
- the potential for radiation exposure to the public;
- the potential for radioactivity to contaminate the environment;
- the potential for other non-nuclear environmental impacts from construction, operation, and transportation;
- LLRW treatment;
- LLRW disposal;
- the potential for nearby property values of homes or lands to be negatively impacted;
- the possible need for additional maintenance of roads leading to and from the facility; and
- additional costs to municipal services which may be required to provide fire and emergency response, facility inspection, and monitoring.

The repercussions of failing to resolve the LLRW problem are also significant. Lack of centralized storage, treatment, or disposal capacity can:

- create an incentive for illegal dumping of radioactively-contaminated waste;
- create potential public health or environmental problems (such as fires, spills, etc.) if LLRW must be stored on site;
- cause users of radioactive materials that produce LLRW, such as hospitals, biotechnology firms and others, to cease applications of these materials. Hospitals may be forced to stop or curtail diagnostic and treatment procedures for cancer and other patients, as occurred in 1979 when the three disposal sites available at that time closed temporarily. Possible curtailment or cessation of the uses of radioactive materials will affect those using these products and services, jobs, tax revenues, and billions of dollars of economic benefit to the Massachusetts economy;
- discourage new business and industry from locating in Massachusetts at a time when new jobs and economic growth are vital to economic recovery; and
- prevent State government from managing LLRW in the most effective, safe, and environmentally protective manner.

While studies indicate that people do not want LLRW in their "backyards," almost everyone agrees that a need exists to site certain types of LLRW facilities to manage LLRW properly.


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